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AUG 5 1933

Engineering News-Record

Excavating Manhattan schist within a 15-acre cellular wall cofferdam in constructing New York City's three 1100-ft. ocean liner piers.

Photo by Fairchild Aerial Surveys, I

New York Piers for 1000-ft. Ships . . . . Securing a Contract at the Right Price . . . . New Plans for the Mississippi-VII . . . . Catenary Steel-Plate Roof . . . . Concrete Bridge for a Rustic Setting . . . . New Side-Contraction Flow Meter

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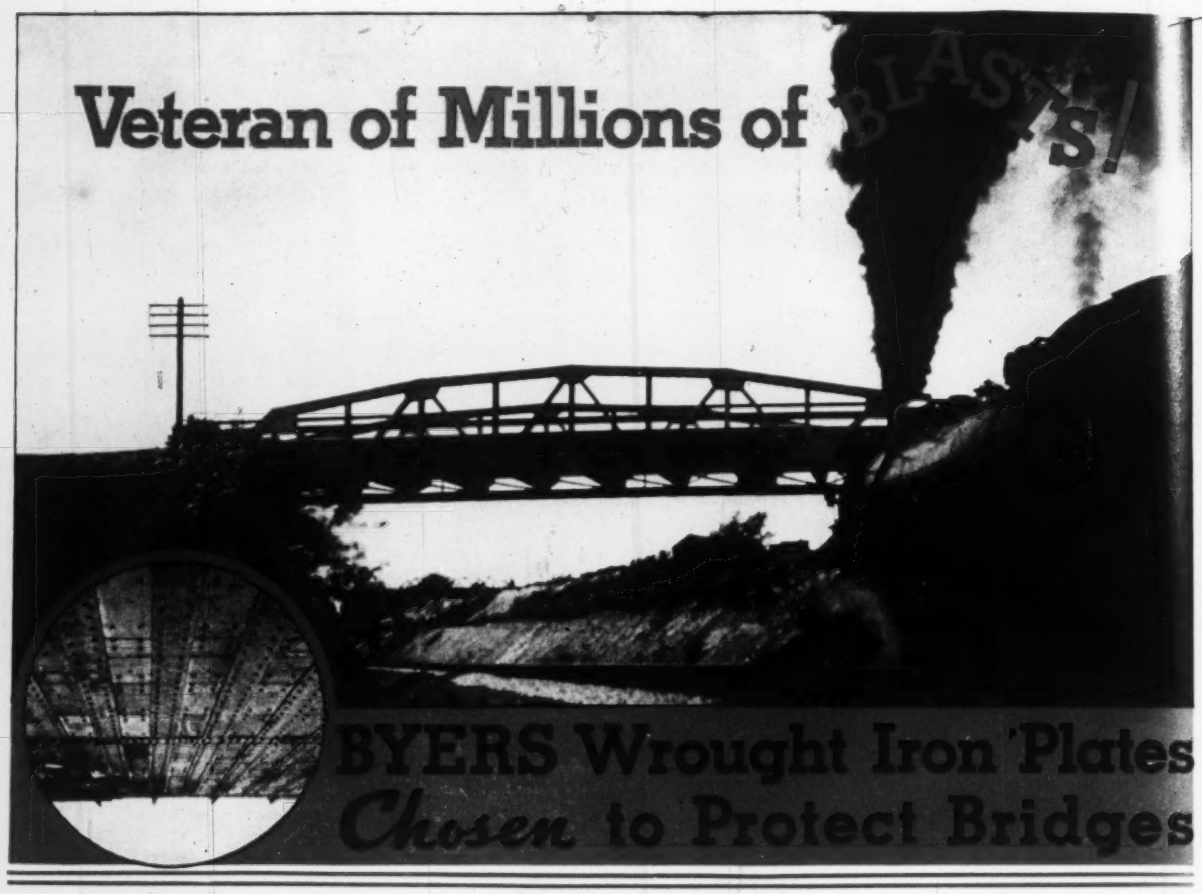

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New York Piers for 1,000-Ft. Ships

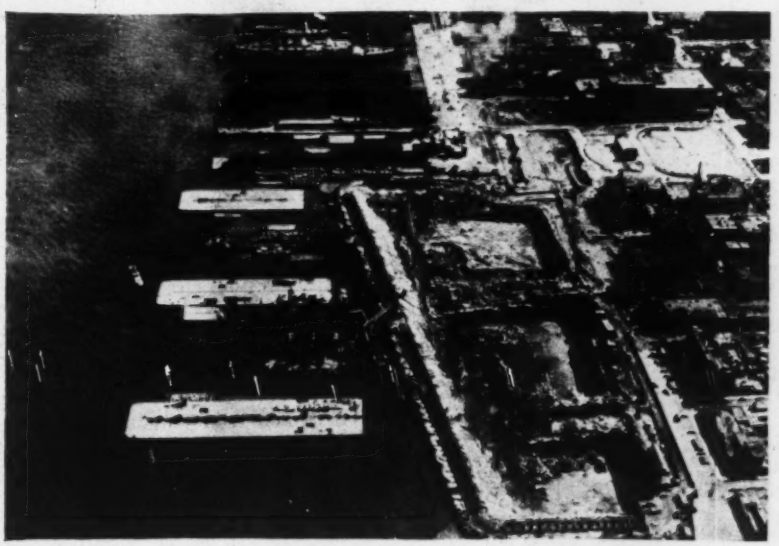
Group of three 1,100-ft. piers constructed in 15-acre cofferdam 2,039 ft. long of steel sheetpile cells—Over 1,000,000 cu.yd. of earth and blasted rock handled in the operation

MORE THAN 625,000 cu.yd. of excavation, two-thirds of a mile of retaining wall from 10 to 56 ft. high within a cofferdam inclosing 15 acres, and 1,000,000 cu.yd. of earth and rock to be handled give exceptional construction importance to three new North River piers now being built by the department of docks of New York City. The new piers are three of a group of five designed to berth ocean steamers longer than 1,000 ft., and they are located between 48th and 52nd Sts., Manhattan. They are 1,100 ft. long and 125 ft. wide, with slip widths of 400 ft. in which a 46-ft. depth of water at mean low tide is provided. These are the greatest berthing accommodations yet planned for the city; they also include new details of pier structure and the unusual feature of obtaining length by cutting into the mainland.

The general elements of the new pier structures are indicated by Fig. 2. Each pier consists structurally of two parts, the longer part being a timber-pile structure with a concrete deck, now standard with the department of docks, and the shorter part being fill retained by concrete walls. The filled part also has a concrete deck. Over the concrete deck of both parts is a two-story standard pier-shed superstructure. This superstructure is supported independently of the deck on separate concrete footings on pile clusters in the case of the timber-pile structure and on concrete piers going down to rock in case of the retained-fill structure. It has cross-wall fire stops at intervals of 140 ft.

Fig. 1—Air view of pit and construction plant for building three 1,100-ft. ocean steamship piers on the North River between 48th and 52d Sts., New York City.

Fairchild Aerial Surveys, Inc.



The present contract includes the pile piers and their concrete decks, the retaining walls and columns (but not the decks) of filled piers, the excavation and the backfilling of the filled piers. The operations divide into cofferdam construction, excavation, concrete-wall construction and pile-pier construction. In case of the pile piers about the only exceptional feature was their construction at the same time as the work within the cofferdam, but with a gap left to be filled in later when the cofferdam was removed (Fig. 1).

Referring to the contours shown on Fig. 2, the pier plans show the filled piers ending at about the line of contour — 46, which was the water depth planned for the berthing slips. This required excavation of all higher riverbed and bank to elevation—46 within the slip areas and to solid rock within the filled pier areas. As described later, this

amounted to about 625,000 cu.yd. of material. Considering also the concrete walls to be built, the engineers of the department of docks decided to lay dry the whole area and have unquestioned assurance of the quality of the work performed. This required cofferdamming the working area in deep water with a tide range up to 8 ft. The area to be inclosed was about 15 acres.

exact length for each cell as determined by borings and by driving test piles, and each sheetpile was marked at the mill to designate its place in the cell. In all, 7,223 tons and 367,773 lin.ft. of sheetpiling were driven.

A design for the cofferdam was made by the department of docks, but contract specifications permitted the contractor to use his own design, subject to the approval of the dock department engineers. The contractor employed H. A. Sloan, consulting engineer, New York, to do the work. The cell structure designed was virtually that shown in Fig. 2, and no considerable supporting inside berm or backfill was contemplated, as the steel structure was considered to be self-supporting. The engineers of the department of docks considered that greater stability was desirable and therefore modified the contractor's design by adding a backfill of riprap on the inshore side of the dam, extending to the top of the cells and making the berm 10 ft. in width throughout the length of the dam. This backing amounted to about 100,000 cu.yd. of broken stone or riprap. The cells themselves were filled with a clayey sand, 180,000 cu.yd. being required. Sluiceways were provided through the cofferdams, as shown by Fig. 2, to flood the inclosure when the work was finished, these openings being closed by sliding gates with worm gears for operation by hand.

In building the cofferdam the site was dredged to El. —30. The effective head of course extends a considerable distance into the mud below El. —30, and at times the tide rises to 8 ft. above low water, creating a head acting against the dam, including both water and mud, as high as 65 ft. in some places. With this head the leakage has been small, a little around the sluiceways and more around the north-end shore connection where water gets through the old bulkhead and finds its way into the excavation. There is also some water from sewer overflow and from rainfall. All water, however, was handled by one 4-in. centrifugal pump. The cofferdam proper is practically watertight.

While without leakage, there has been some movement of the cofferdam cells in places. This movement has been puzzling because the slope of the rock is toward the river, and observations

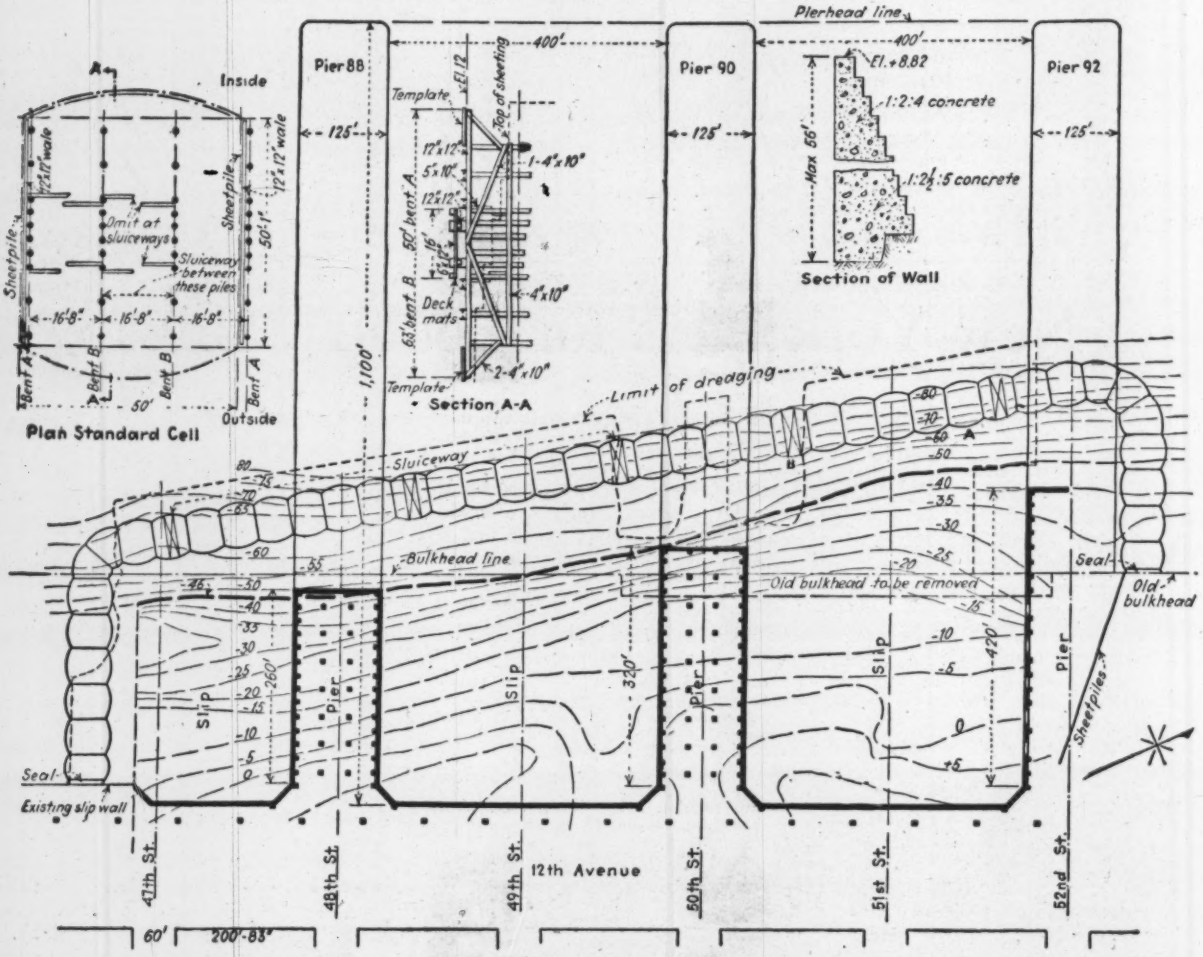


Fig. 2—General plan and essential details of cofferdam 2,039 ft. long for constructing three 1,100-ft. piers on North River at New York.

The cofferdam structure is indicated by Fig. 2. It consisted of 43 cells of sheetpiles forming a river wall 1,450 ft. long, tied into the shore by two end walls each about 295 ft. long, making a total length of about 2,039 ft. Each cell consists of two curved ends (50-ft. radius) and common sides with adjacent cells; the cells are 50 ft. square, neglecting the end segments. The cell walls are steel sheetpiles driven to rock or in places to firm clay overlying rock. Special piles were rolled for the work. The standard section weighed 38.4 lb. per foot, and some of the special sections weighed 42 lb. per foot. An especially strong interlock (8,000 lb. per linear inch) was specified; tests developed strengths of 18,000 to 24,000 lb. The piles varied in length from 46 to 94 ft. They were rolled to

show no increase in elevation and no tilting. It is presumed that the piles may be buckling at the bottom, but this action has not been verified. All the walls have moved inward a little, and the movement is still in progress, but the change of position has been greater at certain cells; cell *A* (Fig. 2), for example, had moved 5.45 ft. inward as of July 1. As the movement has not affected the efficiency of the dam, it has been given no further attention than a close watch and regular charting of the change.

Cofferdam construction

Construction of the cofferdam was mainly a task of driving sheetpiles to exact lines—a templet operation. The procedure was to build a pile-bent trestle along the line of the cofferdam, the bents of which were spaced to carry the guides or templets for the lines of sheetpiling. The bent arrangement is shown by the plan of a cell on Fig. 2. As shown, the bents carried curved steel templets to which the curved end sheeting was driven, with straight wales as guides for the diaphragm sheeting. The caps of the bents carried four 24-in. I-beams, which in turn carried timber mats for crawler-crane tracks, that were picked up from behind and moved ahead by the cranes as they progressed. The cranes swung steam hammers that drove the sheeting as shown in Fig. 3. Two cranes did the driving, one starting from each end of the trestle and working toward the center. A derrick boat was used to handle the piles for meshing and lowering; they were too long for the cranes to handle.

No general difficulty was experienced in driving the sheetpiles. At cell *B* (Fig. 2) one pile either broke the interlock or else split, and to make the cell stable two smaller cells were built inside. All piles were delivered by barges alongside the work and were handled from the barges by the derrick boats equipped with 140-ft. booms. On completion of the piledriving and removal of cranes and mats to the shore, the four I-beams were turned flat and lined with planks to serve as double tracks (Fig. 4) for the trucks that filled the cell interiors, and afterwards as a roadway between shore and two disposal docks built out from the river wall of the cofferdam. These truck tracks were also used for placing the stone backfill for the cofferdam, as shown by Fig. 5.

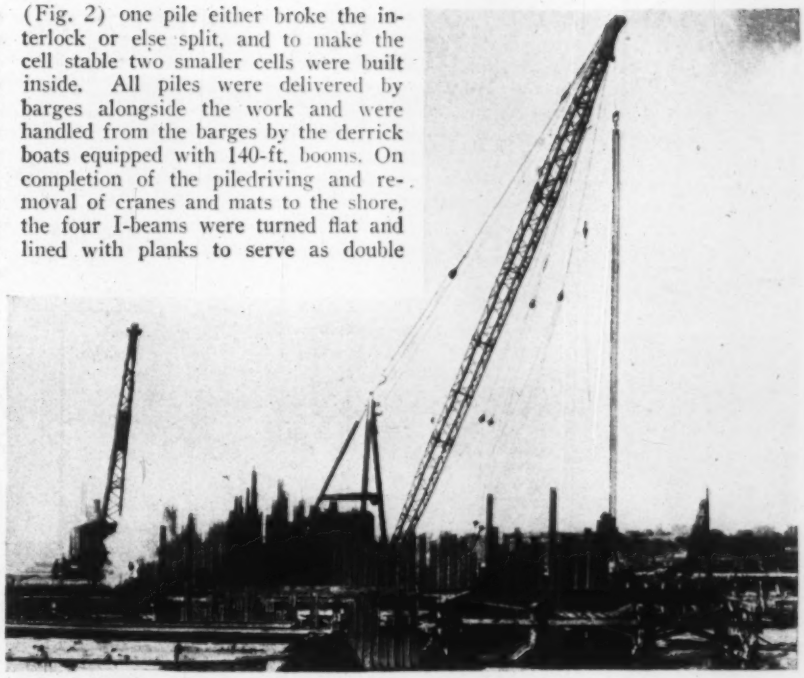


Fig. 3—Templet trestle, piledriving crane and derrick boat for placing cofferdam sheetpiles in constructing three 1,100-ft. piers at New York, N. Y.

Fig. 4—Cellular cofferdam and 15-acre excavation for three 1,100-ft. piers, showing truckway for disposing of excavated material and elements of the wall-concreting plant.

Incidentally, the problem of removing the cofferdam is now being studied by the contractor. In general, it is planned first partly to dredge out the cells and then pull the piles. As the pull is likely to tear out the usual handling holes, the contractor is designing a special grab to take hold of the body of the pile. Piledrivers and a specially designed pulling rig on half a car float will be used for pile pulling.

Excavation

The general character of the excavation is apparent from Figs. 1 and 4.

About 200,000,000 gal. had to be pumped to lay the cofferdam dry. The excavation for the structures consisted of 500,000 cu.yd. of rock and 140,000 cu.yd. of earth overburden. As the removal of the cofferdam will require excavation of 180,000 cu.yd. of clay in the cells and 100,000 cu.yd. of stone backfill, the total of earth and rock handling in the pier operations will amount to well over 1,000,000 cu.yd.

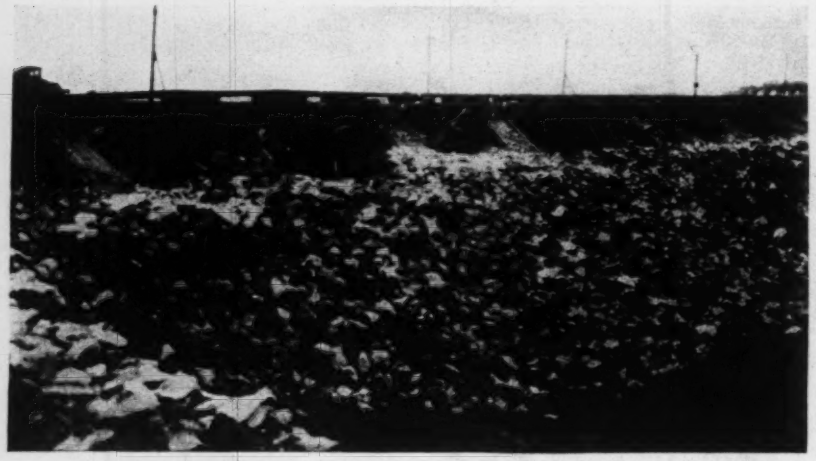


Fig. 5—Stone backing behind cofferdam was placed by dumping from cofferdam truckway through chutes.

It is, however, the rock excavation that is of primary interest.

As shown by Fig. 2, the rock contours slope down from about ground surface on the bank to 46 ft. below water at the ends of the filled sections of the piers. In the slip areas all material above —46 had to be excavated, and in the pier areas all materials above wall and column foundation beds (solid rock) had to be excavated. The views shown in Figs. 1 and 4 clearly indicate this form of the excavation.

The major operation was the deep rectangular rock-cutting in the slip areas. Some of the rock formation is clearly shown by Fig. 6. In general, it was a mixture of formations with mica schist predominating. All formations were irregularly seamed. In making the slip cuts, after removing the overburden and loose surface rock, the sides were line-drilled to ensure a vertical face. Then the core was taken out in 10- to 17-ft. lifts, drilling and blasting by the benching method. The condition of the rock prevented strictly uniform procedure; each shot was drilled and loaded to suit the conditions, using vertical holes generally but putting in horizontal holes when they would help. Three eight-hour shifts were worked, but no work was done between midnight Saturday and midnight Sunday. Floodlights were used for night work.

Air for drilling was furnished by a number of compressors: a gas-powered, vertical, single-stage 1,000-ft machine; an air-cooled, 350-ft. portable, five 310-ft. portable and one horizontal two-stage 350-ft. portable. A 6-in. air main ran along the land side of the work with branches into the pit. Three drifter drills mounted on a sliding frame did the line-drilling, and one mounted on a truck was used in the cuts. Line-drill holes were put down 12 in. apart to —46, and between them intermediate holes 15 ft. deep were drilled. About 2,900 lin.ft. of cut was line-drilled. In the cut, jackhammers were used almost exclusively; 36 were in stock and 25 of them were operating continuously. The steel was handled to the drills by hand from the sharpening shop equipped with sharpeners, oil furnaces, shank grinders and all necessary tools.

Blasted material was loaded into the trucks by seven 1½-yd. gas shovels. Three gasoline cranes handled heavy wire mats used to cover each shot. The excavated material was hauled by a fleet of 30 trucks, most of them of 10-ton capacity. Providing exits for the trucks from the hole was a problem. Three timber ramps were built from the street side of the site down to the bottom of the hole, passing down over the land sections of the three piers. From the north ramp of the three the lower end curved southward into the area between piers 90 and 92. The ramps at the other two piers split at the bottom and turned into each of the adjoining areas. A tractor bulldozer kept the ramps free of spilled material. The ramps were fairly steep, and to provide traction for the hard-tired trucks a lacing of old cable was fastened to the ramp deck. Occasionally a tractor had to assist the trucks up the hill. Also a man followed along behind the truck with a block in case the truck started to roll back.

The loaded truck, upon reaching the top of the ramp, went to the nearest shore end of the cofferdam and traveled over the cofferdam to one of the two unloading piers. One of these piers was equipped to dump directly into dump scows. This material, consisting of small stone and earth, was usually disposed of up the Hudson River shore line along the west side of Manhattan in spaces designated by the park board for filling in the shore. Rock too large for dumping into the dump scows (rock loaded by slings handled by a crane at the bottom of the hole) was dumped onto the other unloading pier. From this pier the stones were loaded onto scows by means of slings or grapples handled by a crawler crane. Most of this large stone went out to Rockaway Point for use on the Rockaway Point jetty (*ENR*, May 4, 1933, p. 547). Material rejected by the inspectors as unfit for park filling was dumped into seagoing scows for disposal at sea.

Fig. 6—Character of rock formation excavated for new pier slips. Note precast concrete-block bulkhead wall founded on bagged concrete and constructed in 1889. Concrete has been submerged 44 years in seawater. (See also Fig. 8.)

As shown by Figs. 2 and 6, a part of the excavation for the new work embraced an old bulkhead wall. As representing practice of an earlier era in concrete construction, the history of this wall has been obtained from F. T. O'Keefe, chief engineer of the department of docks.

The bulkhead wall known as the

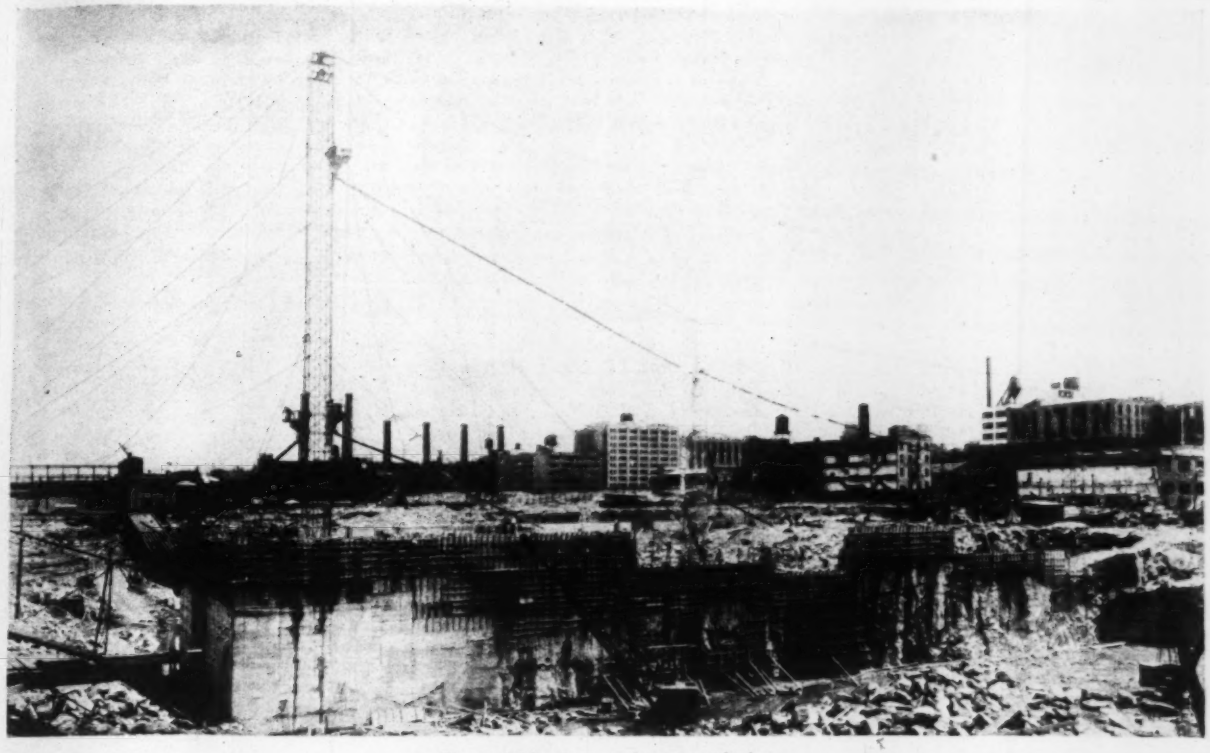


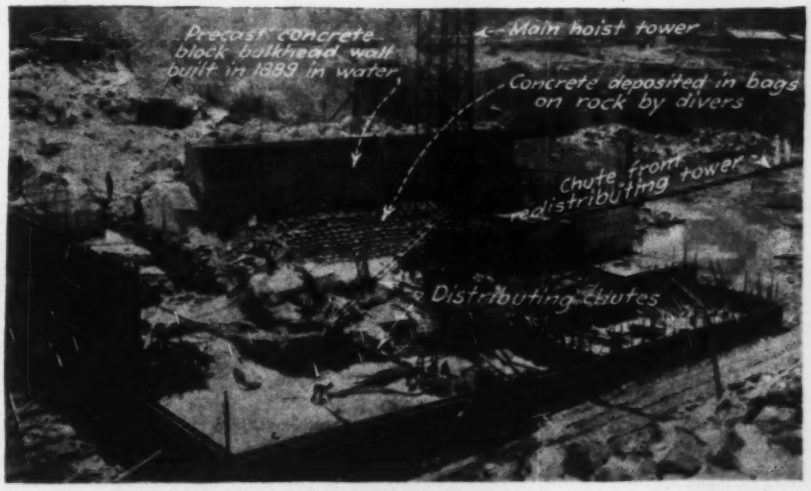
Fig. 7—Main tower and concrete-chuting system for pier walls; end walls 56 ft. high will be in 46-ft. depth of water when submerged.

West 52d St. section was begun on April 27, 1888, and was practically completed on Jan. 29, 1890. Owing to the small distance of the rock bottom of the river below mean low water in this locality, no wooden-pile foundation was placed. The wall is concrete from the rock bottom to the top.

The bottom was first cleaned of mud, etc., as thoroughly as was practicable, by dredging, which, however, did not remove the material lying in holes and pockets in the surface of the rock. The mud and rubbish that lay in these holes and pockets was then removed by pumping, which work was supervised by the dock department divers until the whole surface of the rock was cleaned. Bags of about 4-bu. capacity were filled with concrete and placed so as to form a seat or resting place for the concrete blocks. The blocks were then set in place upon these bags, and the granite coping and the concrete backing were built. The rock occurred in this locality at an average depth of 35 ft. below mean low water.

This wall between October, 1889, and December, 1891, showed a movement of about ½ in. outshore. Near the lower end of the section there was an inshore movement of about the same amount, and during the three years following 1891 the inshore movement became more general and reached a maximum of 0.1 ft. The greater portion of this section of wall has therefore moved a trifle inshore. Levels taken show no appreciable settlement. The wall cost about $336 per linear foot. When uncovered for the new work the concrete blocks in the wall were in just as good condition as they were the day they were placed—that is from 1889 to 1933, or a length of time of about 44 years. There had been no disintegration of the concrete. The concrete was all mixed by hand by the dock department forces, and the mixture used was 1 cement, 2 sand, and 5 1½-in. broken stone (trap rock). The cement was American manufacture.

Fig. 8—Lower pier-wall forms and chuting system at bottom of main-hoist tower through which concrete is being placed in the 56-ft. end wall. In background, granite coping is being removed from old block-concrete wall built in 1889.


Precast concrete block bulkhead wall built in 1889 in water
Main hoist tower
Concrete deposited in bags on rock by divers
Chute from redistributing tower
Distributing chutes

New retaining wall

The new retaining wall inclosing the land portions is shown in cross-section on Fig. 2. It varies from about 10 ft. to 56 ft. high. The specifications allow plum or derrick stones below the top 12 ft. of the wall, and these plums were saved in the excavation from the better rock taken out. The concrete for the upper part of the wall was 1:2:4 mix and in the lower part 1:2½:5.

All concrete for the new walls is handled by towers and chutes, essen-

tially an independent set-up for each pier. Figs. 7 and 8 show parts of the plant.

The concrete is mixed in a mixer boat set outside the cofferdam and is chuted from the mixing plant to the base of a steel tower set just inside the outshore end of the land section of the pier. This tower is 210 ft. high. From the top of the tower a chute line 300 ft. long reaches the inshore end of the land section. Shorter chutes take off from the tower at various heights for disposal of concrete toward the west end of the land section.

The mixing plant is steam-operated and consists of a complete weighing-batching plant, a mixing plant with a 1-yd. mixer and a steel tower, all mounted on a barge. The barge is equipped with fresh-water tanks, and two pumps distribute the water over the plant. Also mounted on the barge is a locomotive crane, anchored down, for charging the mixing plant.

Sand and stone scows are set on each side of the barge. Cement is delivered by barge in bulk and is pumped by an air-conveyor system to an 850-bbl. storage bin on the barge. From this storage bin the cement is conveyed by a vertical screw to the top of the concrete plant, then by a horizontal screw to the cement batcher.

A steam hoist lifts concrete in a roller-hoist bucket up to the tower on the plant, from which it is distributed to the land tower by means of a counterweight chute. The counterweight chute does not extend as far as the high tower but ends at a short tower built just within the cofferdam. From this tower another chute line carries the concrete to the base of the high tower.

Personnel

The new piers are being built by the department of docks of the city of New York. John McKenzie is commissioner of docks, F. T. O'Keefe is chief engineer, and A. J. Duggan is resident engineer in charge. The general contractor is Allen N. Spooner & Sons, Inc., New York. W. A. Morton is superintendent in charge of work for the contractor. Clarence L. Smith, Inc., is subcontractor on all of the rock-excavation work. The firm of Ryan & Davis, New York, was subcontractor on the filling of the cofferdam pockets. The Bouker Contracting Co. handled the disposal.

Analysis of Flood Produced by Severe California Cloudburst

WITH a maximum recorded precipitation of 4.34 in. in five hours, a severe cloudburst in the Tehachapi Valley, Southern California, resulted in a flood peak which a series of subsequent measurements placed at about 300 sec.-ft. per square mile average, with several individual calculations exceeding 500 sec.-ft. From existing rainfall records in the area the probable frequency of such a storm is estimated to be about 90 years. Damage done by the flood in the Tehachapi Canyon included the loss of nine railroad trestles and bridges together with several miles of track at an estimated loss of $580,000, and highway repair work placed at $45,000. The number of lives lost was placed at fifteen.

On Sept. 28, 1932, a tropical disturbance from the Mexican coast moved north along an unusual course with diminishing intensity and broke up in the Tehachapi Mountains, where the topography forced the convergence of the rain-bearing wind, resulting in precipitation of cloudburst proportions on Sept. 30. The area of maximum intensity probably covered a comparatively narrow belt, roughly 10 miles wide by 20 miles long. The closest U. S. Weather Bureau station, at Tehachapi, reported a 4.34-in. rainfall during a five-hour period with only a small amount before and after. It is entirely possible that the point of greatest intensity did not coincide with the station.

The resulting floodflow, in general, originated in the area south and east of Tehachapi, sweeping across the valley in wide channel streams that later concentrated in a flood down Tehachapi and Caliente Creeks, debouching on the Caliente Creek debris cone north of Arvin. In the upper part of the flood area the principal damage was caused by the deposit of sand and debris in roads and fields. Farther down the canyon the highway and railroad were washed out, and at Woodford the collapse of a railroad fill that had formed a temporary dam produced a flood wave that resulted in the loss of several lives. Immediately after the flood the state engineer's office undertook an extensive survey of field conditions, gathering data on the rainfall and floodflow in the area. From the report of this survey the following information has been abstracted.

Estimates of peak floodflow were made from actual cross-section and profile surveys combined with the observed high-water marks at sixteen locations in the area. As is the usual case in such determinations of flood peaks, various unmeasureable factors undoubtedly affected the subsequent estimates. For example, the alternate damming and releasing of water behind railroad fills and trestles had an effect that would tend to lower the flood crest. In general, although bridges were destroyed and fills were overtopped and undermined they were not destroyed. The effect of these structures was believed to have diminished and spread the flood peak rather than increased its size. The possible exception was the washing away of the railroad fill at Woodford.

Field determinations were made at sections where a channel was reasonably uniform for some distance and where evidence of erosion and deposition were at a minimum. These conditions were difficult to obtain in the steep canyons of the area, but it is estimated that probable error in flood-peak measurements is less than 20 per cent. Cross-section data were obtained by stadia surveys, and sufficient information was obtained to permit the plotting of sections and profile for the point of measurement.

Out of the sixteen observations and calculations made, three showed an extremely low discharge, and three others indicated a questionably large floodflow which in two cases, was definitely noted as resulting from heavy erosion in the channel. If these three low and three high determinations are eliminated, the average floodflow for the other ten determinations was 290 sec.-ft. per square mile on an average drainage area of 93.8 square miles. Three of these ten determinations equalled or exceeded 500 sec.-ft. per square mile.

The available precipitation records in the vicinity are not continuous and aggregate a total of 27 years. This record is considered too short for the proper basis of estimating recurrence of floods with periods of three to four times the length of the record. However, because of the importance of the recent flood records, it was considered advisable to complete the frequency analysis for such value as it might have. From the existing records the frequency rainfall curve was plotted, which shows indications that a 2.4-in. daily rainfall can be expected once in ten years, a 3.7-in. rainfall once in 50 years, and the 4.3-in. rainfall producing the recent flood at an estimated probable frequency of 90 to 100 years.

The flood survey and preparation of data were made by Robert L. Wing, associate hydraulic engineer, under the supervision of A. D. Edmonston, deputy state engineer. Edward Hyatt is state engineer and chief of the division of water resources.

Rubber in Road Surfaces

A report on experiments being made with rubber on road surfaces in Singapore has been made to the Bureau of Foreign and Domestic Commerce, Washington, D. C., by the trade commissioner in Singapore, and is available for review by interested American firms.

Ten Business Problems of Contracting

II—Securing Business at the Right Price

The right price is the best price the market affords—Business trends influence market—Competition and not cost sets the price—Search out special conditions in setting bid price

By J. L. Harrison
Senior Highway Engineer, Bureau of Public Roads, Washington, D. C.

MOST of the literature that deals with the problems of the contractor emphasizes the thought that the management of construction is the essence of contracting. Beyond a doubt there is something to be said for this point of view, for quite regularly a great deal of the profit which would have been obtained had construction been properly handled is lost on account of inadequate construction management. Nevertheless, when contracting is viewed in its broader aspects, it becomes apparent that while the management of construction is one of its more important elements, it can hardly be rated as the most important. Perhaps it is inexpedient to rate any particular element of any undertaking as of this degree of importance. Still, as all other phases of any business are necessarily dependent on having business to handle, there is at least some reason for saying that securing this business is the most important phase of business activity. Certainly it is true that until business is secured, none of the other problems of its management arise, and that unless there is business to handle any firm must eventually disappear. So it would seem logical to conclude that securing business is a matter of first importance in contracting as it is in other lines of business endeavor.

Business at the right price

But it is hardly sufficient merely to say that securing business is a matter of first importance, for coupled with this fact and part and parcel of it there is an equally important consideration—that business be secured at the right price. Obviously, this is important, for it affects the possibility of reaching that primary objective in all business activity—profit.

But the importance of securing business at the right price goes even farther than this. In all business fields—in contracting neither more nor less than in others—there always is active competition for whatever business is to be had. Occasionally the contractor finds that he is working in a seller's market—that is, in a market in which the demand is so great that sellers dominate the establishment of prices. But far more commonly the contractor is forced to work in a buyer's market—that is, the volume of work offered is so small and competition so keen that the buyers dominate it.

As every price at which work is taken influences the current market, any price that is out of line affects the trend of the market. In a seller's market this is not of so much importance, for sellers can then very largely disregard prices that are out of line; but in a buyer's market such prices are harmful to the business as a whole as well as to the individual contractor who makes them, because quite commonly they are accepted by both contractors and owners as establishing a revised price level, with the result that for an extended period prices cannot again be forced above the level so established.

Some two or three years ago the writer attended two successive letfings at a point in the Mississippi Valley. At both of these lettings a good deal of highway grading work was offered. At the first letting, except for one project on which a bid of 27c. per cubic yard was entered, the price ruled at about 33c. At the second letting, bids at not above 27c. were received on every job offered. The demoralizing effect that "out-of-line" bids have in a falling market can be no better illustrated than it was in this instance.

From the business standpoint the right price at any given time and place for work of any given kind and quality is the best price the market will provide. The farmer whose business is raising wheat never thinks seriously of proposing that he shall be paid his cost of producing wheat plus a profit. He raises wheat without much regard to the market price for it because he is equipped to raise wheat and very likely is not equipped to raise anything else. When his wheat is harvested, he markets it at the best price he judges that the market will afford him and then sets about it to produce another crop that may be more profitable or less profitable than his last one. Above all, he never sells below the market because his cost of production is such as to give him a fair profit at less than the market price, and he never attempts to sell above the market because he knows this simply cannot be done! In short, he realizes that prices are set by conditions over which, as an individual, he can exercise no control, a situation which limits him in this field to a selection of the best time and the best place in which to sell.

And though there is much literature to the contrary, the fact remains that the situation which contractors face in securing business is not very different from the conditions that farmers face in selling grain. The current market price on the products of construction activity are not as clearly and as publicly of record as the prices on grain, but otherwise the situation that contractors face is very much the same as the situation that farmers face. Work can no more be obtained above the market price in the construction field than it can anywhere else. Neither can it always be had at profitable levels. But if the contractor wishes to stay in business as a contractor, he must take business in bad times as well as in good times, just as other businessmen do.

Business trends and price

The fact that business cycles are attended by wide fluctuations in the volume of business that is offered has been noted in a previous article (*ENR*, July 20, 1933, p. 73), as has the fact that these changes in the volume of business produce wide changes in the intensity of competition and in price levels. But while a great deal of information on the volume of business always is available as well as a reasonable amount of information on price levels, there is no such openly established market price for construction work as there is for commodities, including many of the materials of construction. On this account, if a contractor is to obtain the best price the market provides, he must be a close student of the conditions that influence prices. Naturally, it is quite essential to know local conditions in so far as they affect construction work. It is equally essential to know the general trend of the volume of business. Otherwise, he can hardly expect correctly to gage their influence on price levels and on the specific prices that will govern the award on a given job.

Obtaining reliable information as to the local trend of business is not always an easy matter; but if a definite effort is made to obtain it, the information that can be had from banks, large mercantile establishments, factories, etc., will be found to be quite satisfactory. In addition to such information, a knowledge of local conditions includes familiarity with such matters as the bidding practices of competitors, with

the business that competitors can handle and are handling, and with the volume of prospective business. It also requires a detailed knowledge of prevailing wage levels and of their trend.

As to regional and national trends in price, in wage levels and in the volume of business, the information readily available is more accurate and more voluminous than any available as to local conditions, except as the term "local" may apply to work in one of the larger cities. For some years *Engineering News-Record* has regularly published a great deal of valuable information on business conditions both in graphical and in statistical form. Quite recently the U. S. Bureau of Public Roads has begun the publication of an index of price trends in the highway construction field. The *Survey of Current Business*, published by the U. S. Department of Commerce, is another source of valuable information. There are, of course, many other useful and reliable sources. But without going further than to study the information that appears each month in *Engineering News-Record*, the thoughtful contractor can readily determine whether he is working in a rising market or in a falling market, and whether on account of the position of the market he can increase prices and still obtain business or must further reduce them if he is to obtain even a limited amount.

Competition sets the price

In these comments there has been practically no reference to cost as an influence on price. The plain truth of the matter is that so far as the individual contractor is concerned, cost is and must remain a secondary consideration. The objective is to obtain business. All that any man can do is to obtain it at the best price the market offers. On the other hand, it is equally essential that it shall not be obtained at prices that are out of line with the market. The natural conclusion is that the most successful bidder is the man who is able so accurately to gage the market that his prices are the best the market will provide, but who can still obtain his share of the available business.

The manner in which business is obtained does not offer any avenue of easy escape from the effect of prevailing price levels or the effect of these levels on the margin of profit. This should be apparent and probably is. In the last analysis both the general level of prices and the general margin of profit are the result of the intensity of the competition at the moment prevailing, and the effect of this competition remains about the same whether business is obtained as the result of public competitive bidding, private bidding, private negotiation or promotion.

On the other hand, there usually is a little better opportunity to preserve a margin of profit on large projects than on small ones, and a little better opportunity to preserve a margin for profit on work on which special skill or special quality are required than on work involving standard skill and quality. That this is true is due to the fact that here, as in all specialty work, the intensity of competition is measurably reduced. There are, as an illustration, thousands of contractors who are able and willing to build an ordinary frame house, so the competition for any work of this sort is very keen. There are only a few who are competent to handle such a structure as the magnificent Empire State Building, so, no matter when such a structure is offered, the intensity of the competition for the business it offers, though still active, is not likely to be quite as intense as it is in the small-structures field.

The major fraction of all construction work is let on the basis of competitive bidding, either public or private. The customs and practices that are involved in bidding need no discussion here, for they have little bearing on securing business which, when work is let on this basis, obviously is a matter of pricing. Where competitive bids are asked, presumably the work will be awarded to the lowest responsible bidder. This is the natural as well as the usual result, for the plans and specifications are presumed accurately to describe the thing to be built; and if the award is to the lowest responsible bidder, the owner merely acts to accept the lowest price at which a contractor, capable in all ways of building it, has offered to do so. The fact that the specifications carefully define materials, methods, practices, etc., precludes competition on any other basis.

Assuming that a contractor is responsible, as that term usually is understood, the problem faced in an effort to secure business on the basis of competitive bidding is then clearly a problem in pricing. The problem may be solved in either of two ways—by an analysis of cost or by an analysis of differences—that is, of the facts which will cause the prices on the work under consideration to differ from the recognized market price for work of this sort.

The effect of the various published discussions of bidding, most of which emphasize the desirability of basing bids on careful estimates of cost, has been to lead a good many contractors to make more or less complete estimates of the cost of work on which bids are to be entered. The writer offers no objections to this procedure, though he feels that too often the results obtained are a bit grotesque.

Recently an occasion was offered to examine a number of such estimates. Most of them were quite accurate as far as they went. But—and this was the interesting thing about all of them—as soon as the total accumulated had reached a point beyond which it was apparent that the inclusion of other items of expense would result in a price at which business could not be obtained, all remaining items of expense were omitted. The contractors who had prepared these estimates had gone through most of the steps involved in estimating the cost of the work on which the bids had been entered, but, whether they recognized the fact or not, actually they had bid on the basis of the market as it had been established by themselves and by other bidders. Clearly, all of them had concluded that if business was to be obtained, it would have to be taken at the prevailing market price whether this would cover cost or not. Undoubtedly this conclusion was correct.

Calculating a bid price

In preference to the solution of the pricing problem by an approach of this kind, the writer feels that the contractor is in a better position to obtain business at a proper price if he will give his major attention to an examination of the factors that should cause the price of the work on which he plans to enter a bid to vary from the recognized general price level. As an illustration, it may be assumed that the work in mind is an excavation for a new building. The prevailing price on excavation of this sort is 50c. per cubic yard, a price that has been steady for the past three months. General conditions are such as to indicate that the market now is steady to strong. The prevailing price is based on jobs involving the excavation of 1,000 to 2,000 cu.yd. of material and hauling it about 2 miles to a public dump. This job involves handling about 5,000 cu.yd. of ordinary common excavation and hauling it about 1½ miles. Other job conditions are normal in every respect.

Starting, then, from an appraisal of local and of general business conditions that had led to the conclusion that the market is firm—that is, that there will be no tendency to reduce the basic market price of 50c. a cubic yard and that conditions are such that it may be possible to push this price up a trifle, the contractor's first problem becomes one of determining what price on this job will harmonize with the prevailing market price for work of this general character. The first factor to be considered is the cost of placing equipment on the job. As long as only one shovel is involved, the size of the job does not affect the cost of bringing in this equipment which, it may be assumed, is $150, or 10c. per cubic yard for a job of average size. For this job it will be 3c., a net saving of 7c. per cubic yard.

Hauling costs 20c. a cubic yard for a 2-mile haul. For a 1½-mile haul, the cost will be 17c. and the saving 3c.

Clean-up and the removal of equipment on an average job will cost $150, or 10c. per cubic yard. On this job it will cost $200, or 5c. a cubic yard, the net difference being 5c. a cubic yard.

Other conditions being normal, a price of 35c. on this job is, then, in exact har-

mony with the prevailing marke price.

The contractor has now reached the critical point in determining what to bid. Can he bid more than 35c. and still obtain business, and, if so, how much? The market is firm. Therefore, no one is likely to try to cut the price. Some bidders are pretty certain to try to raise it a little. But, above all of this, how many competitors are likely to apply the market price to this job correctly? Probably all of them will compute the difference in hauling cost correctly, for this is likely to be a subcontract, but how many will note the effect of the larger yardage on the unit cost of getting onto this job and the unit cost of the clean-up? Here a knowledge of the practices of competitors is invaluable, for if it is pretty certain that none of them will take these matters into consideration a bid of at least 47c.—12c. above the market—is logical. But, if other bidders are likely to give these matters proper consideration, there is no chance of getting the business at much over 35c.

The particular advantage of this method of preparing bids lies in the fact that it focuses attention on the conditions that ought to cause the price named on a specific job to differ from the generally prevailing price for work of this character. In general, no contractor is able to obtain much work at a price above prevailing levels, no matter what his costs may be. Therefore, setting up a record of what, in his opinion, it will cost him to do the work is a more or less useless effort, for even after he has done this he still must base his bid on prevailing market prices, as practically all contractors are finding it necessary to do at this time. But, if instead of making an estimate of total cost, an appraisal is made of the special conditions that affect cost, the market price being taken as the basis from which to work, there is a dual result. The contractor has for his consideration a figure which is, in effect, the market price as applied to the work on which he proposes to bid. He also has for consideration a statement of the points at which divergences from the general market price arise and the amount of these divergences.

Finally, as to this matter, this statement of divergences serves several purposes. In the first place, if carefully worked out, it prevents taking work on which costs will be high except at a proper price. There are a good many such jobs—jobs with hidden elements of cost. The adjustment of the general market price to conditions on such jobs, if accurately done, results in a bidding price that is in line with the prevailing market. If the work is secured, it is secured at a proper figure. More ordinarily, the result is that someone who has not given full consideration to hidden costs takes the job.

Where there are hidden elements that tend to reduce cost, a knowledge of these elements coupled with a knowledge of how competitors are likely to bid gives considerable room for the exercise of judgment as to whether and by how much an advantage can be taken of them.

But, above all, this system of preparing bids is a guarantee that the price set will harmonize with the prevailing market—that when margins of profit are wide, they will not be sacrificed merely because an estimate indicates that the work can be handled for less, and that when prices are falling the prices asked will not be so high as to make it impossible to secure business. Contracting is an effort to secure profit in the construction field. None that is available should be sacrificed.

In presenting this theory as to the preparation of bids, it is not intended to imply that estimates of cost need never be prepared, for this is not the case. This method of preparing bids is valuable in pricing work so commonly performed that a market price on it has been pretty definitely established. In the nature of the case it cannot be used to the entire exclusion of the more accepted practices in preparing bids on exceptional or unusual jobs, on jobs where special skill or extra quality are required, or in preparing bids on work to be done in a region where the prevailing standards of quality and the usual meaning of important clauses in the specifications are unknown. Work falling in these categories is, of course, subject to the influence of general price levels, but as a rule the safest policy in regard to it is to prepare estimates of cost and then to bring these estimates into agreement with the existing level.

Negotiating and promoting work

Where work is let by negotiating a price for it, any one of several conditions may dominate. Some firms specialize in large structures and are equipped and manned to handle work of this kind better than firms that do not specialize in such structures. Some firms specialize in quality work. Some specialize in limited or unusually difficult fields. Some specialize in standardized construction. When work falling in any of these lines is to be undertaken, the special fitness of certain firms to handle it and the reputation that these firms have established for clean-cut fair dealing all tend to make it desirable to negotiate a price rather than to ask for competitive bids. The number of real specialists in any line is not large. This tends to reduce competition; but it does not eliminate it, nor does it enable even the best of the specialist firms to avoid the effect of general price levels on the prices they quote. Profits are good in good times and at best very narrow when times are bad, just as in the case of firms that take their work on the basis of competitive bidding.

Another advantage offered by negotiating a price is that specialty work usually commands a modest premium over standard work, just as special grades of commodities usually command a premium over standard grades. But—and this fact should never be overlooked—specialty work is very apt also to involve special costs. There is some advantage in the fact that the process of negotiation should have revealed all the special costs, with the result that the price finally reached should cover them. But the standing that a contractor has as a specialist must be preserved at any cost or his advantage as a specialist is lost. There always is an element of possible expense here, which it is necessary to consider in any appraisal of the position of specialist work. The fact that the number of firms that have been able to maintain themselves as specialists is relatively small would appear to add weight to the conclusion expressed above that securing work by negotiating a price for it provides no easy escape from the general effect of competition on price levels and profits.

Promotion as a means of securing business offers attractive possibilities to those who are equipped to handle it. By whatever means business is secured a search for it must be made, and after it is found, active steps must be taken to secure it. Promotion goes back a step or two further. It implies finding a need which others may or may not have seen but which they have found no means of satisfying, and then arranging the means, as well as securing the work and performing it.

The writer's first contact with promotion came a good many years ago when one of his friends, now a wealthy contractor, was thrown out of work. In looking for something to do he reached the conclusion that many of his neighbors needed concrete sidewalks—then a relatively new thing. They readily agreed but said that they could not find the money to pay for them. A banker was consulted. Yes, he would loan the money. The neighbors were again approached. Ten dollars down and five a month until the notes were liquidated was the result. Within two months this young man had several outfits building concrete sidewalks to the satisfaction of his clients, to the profit of the bank and at a fair profit to himself.

As in this case, promotion always involves the discovery of a need—and it may not be a need involving a large expenditure, though in many cases it is—the development of a means of meeting this need, and the creation of a willingness to accept these means, in addition to the work ordinarily done in securing business. Because of this extra effort and its highly specialized nature, many contractors never attempt to promote business. Admittedly, a good deal of specialized effort is involved, but as a rule this effort is well repaid if the promotion is at all successful. However, it should be noted that securing business by promoting it

is an all but hopeless task because banking support is so difficult to secure. In good times the volume of other business is so large that relatively few contractors care to make the effort required in promoting additional business, though those who do so usually find it profitable.

Just at the moment the banking situation is such that promotion is exceedingly difficult. However, if, as we all hope, we are nearing the end of the period of serious strain on the banks, a period is approaching in which the banks are likely to find that the funds at their disposal exceed the demands normally made on them. Such a period usually follows a depression and precedes the period of stimulated business activity commonly known as good times. In such periods the banks usually are anxious to obtain business, so they are inclined to look with favor on meritorious promotions of all kinds. As such a period appears to lie in the immediate future, contractors would do well to give the possibilities of promoting new business in the regions in which they operate special consideration at this time.

New Flow Meter Uses Side Contractions Only

By Floyd A. Nagler
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TWO YEARS AGO, in contemplating the installation of a venturi meter in the new 48-in. steel pipe line feeding one of the river canals at the laboratory of the Iowa Institute of Hydraulic Research, a novel type of venturi meter, called a "side-contraction meter," was developed.

The type of construction employed in the new meter is only possible in view of the progress that has been made in the art of welding. As shown in the sketch in Fig. 1, the contraction of the flow is secured by two steel plates welded to the interior of a standard section of cylindrical steel pipe, (ABCD), in contrast to the ordinary venturi meter in which the contraction is symmetrical and conical. The section at the throat is almost rectangular in form (EFGH) in comparison with the circular section of the standard venturi meter. An average reading of the throat pressure is secured through a series of holes in the vertical wall of the throat, which open into the chamber formed between the cylindrical shell of the pipe and the contracting steel plates. The pressure in the pipe ahead of the contraction is measured as usual by a ring piezometer or through a large number of openings around the periphery of the pipe.

During the past year a 48-in. meter similar to that described above has been installed at the Iowa laboratory. This type of meter has also been subjected to intensive study by experiments on a 6-in.-diameter model made of transparent pyralin. Experimental results to date show an extremely stable coefficient through a wide range in throat velocities similar to that secured with the ordinary venturi meter. However, the measured loss of head in the side contraction meter was less than that generally produced by a standard venturi meter, indicating that there can be no objection to the rectangular throat.

In the 48-in. pipe installation the contracting plates were reinforced by stiffening webs welded both to the plate and the interior of the pipe. The cylindrical shell of the pipe was likewise reinforced at the throat section against outside pressure by welding angles around the circumference of the pipe. The space between the contracting plates and the shell of the pipe forms a satisfactory equalizing chamber for the series of piezometric openings at the throat. Or the throat pressures may be collected independently of this space by the pipes at I or J in Fig. 1.

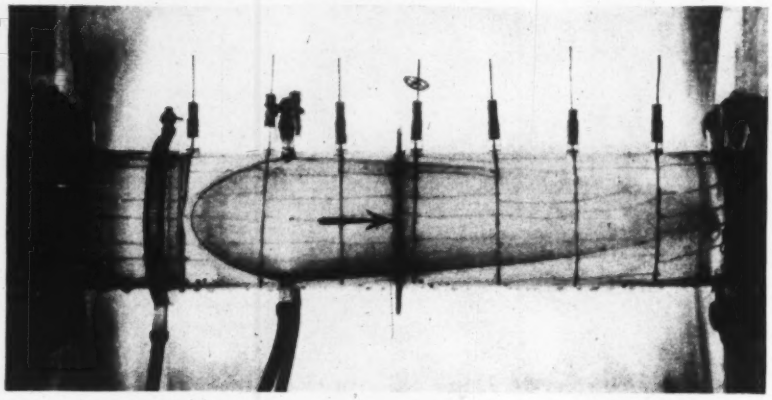
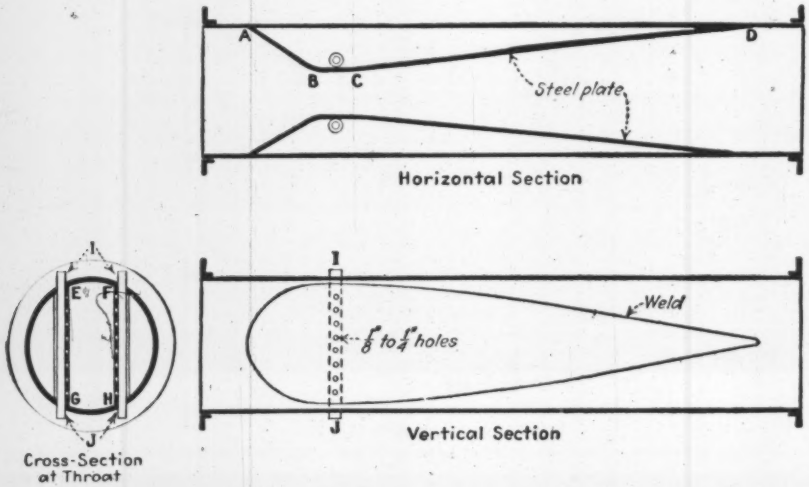


Fig. 2—Side-contraction meter in 6-in. pipe line made of transparent pyralin. Tests show a stable discharge coefficient through a wide range of throat velocities.

Fig. 1—Throat section in new meter approaches a rectangular shape. Silt will not collect or affect flow indication.



As installed in the hydraulic laboratory at Iowa, the side-contraction meter has several advantages: (1) The cost of the 48-in. meter was less than 10 per cent of the quotation of an American manufacturer on a standard venturi meter of this same size and contraction furnished. (2) At times when the water carries considerable silt an accumulation of sediment upstream from a standard venturi meter would result in erroneous measurements of flow. On the other hand, no such accumulation of sediment will take place above the side-contraction meter; it is self-cleaning, and complete drainage of the pipe can be secured at any time. (3) As mentioned above, the meter has a smaller loss of head than the standard venturi meter proposed for this installation. (4) It is possible to measure the discharge when the pipe is only partly filled with flowing water, since under this condition the side-contraction meter is similar to the venturi flume.

NEW PLANS FOR THE MISSISSIPPI

Contraction Works Stabilize Low-Water Channel

Seventh of a Series of Eight Articles

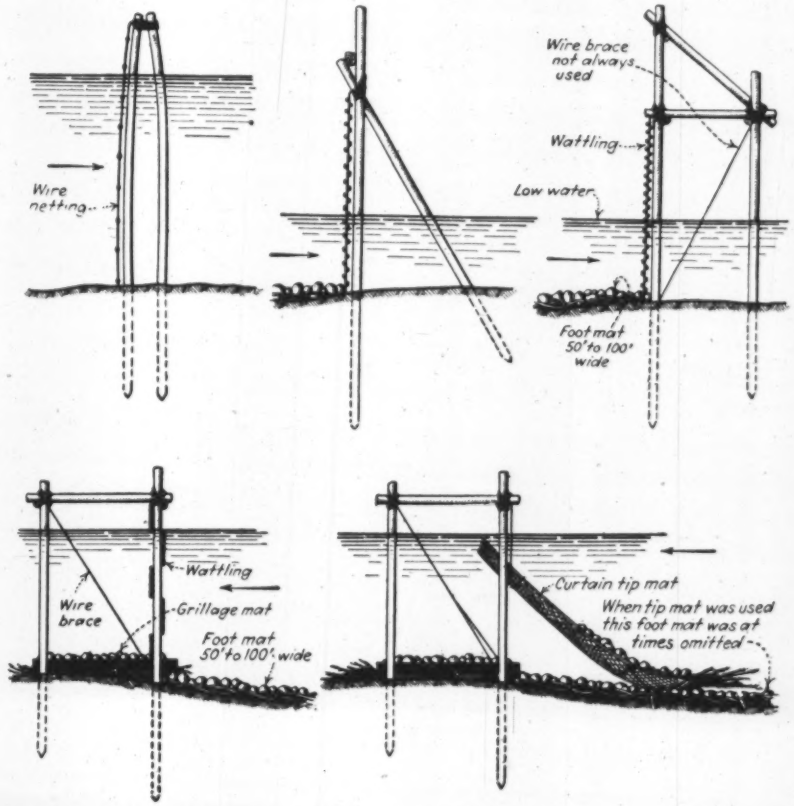
Shallow navigation depths between Cairo and Memphis are being increased by narrowing and stabilizing the low-water channel by means of spur dikes

WITH the adoption in 1928 of the present flood-control project for the Mississippi River, a new policy of navigation improvement was inaugurated. Under this policy, dredging during low-water periods on certain troublesome bars, which since the early nineties has been the established means of holding navigable depths in shallows, is to give way to low-water channel stabilization by permeable dikes. After the stabilized channel has become organized, dredging will continue only as a supplementary resort when occasion demands, and the present elaborate organization and equipment for channel-dredging will gradually cease to function as a primary navigation aid.

The recourse to channel stabilization after a generation of shoal removal by dredging has a logical reason. It took all this time to establish a system of channel contraction, the successful operation of which carried sufficient conviction to overcome the tradition of dredging—only as a means of maintaining navigation depths over shoal crossings. Successful channel contraction requires: (1) a coordinated group of structures (generally spur dikes), each supplementing the others in a combined task of forming new bank lines; (2) a rational location of the structures, including alignment, spacing and distribution between opposite banks; and (3) a design of structure that combines lowest cost and easiest maintenance with strength to resist current attack and current-retarding effect sufficient to cause rapid deposition of sediment.

Early trials of contraction works overlooked one or the other of these interdependent elements, and failure or indifferent success followed. It was a trial of this kind on the lower Mississippi (Plum Point and Lake Providence), as related later, that turned the river engineers to dredging and for 30 years virtually banished dike construction south of Cairo. It was in practice on the Missouri River during this period that the elements became gradually coordinated into a system that offered reasonable assurances of success. Following its extension to the middle Mississippi from St. Louis to Cairo, the system became organized and ripe for consideration in the new project for river improvement south of Cairo.

Fig. 1—Types of early permeable dikes built at Plum Point reach, whose failure led to the adoption of dredging as a means of keeping navigable channels at shoal crossings.



Limits of project

As was stated in a previous article (*ENR*, June 22, 1933, p. 795), the channel conditions that cause navigation difficulties are in that part of the river above the mouth of the Arkansas, about 400 river miles below Cairo. The reach of most difficult navigation is between Hickman, Ky., about 40 miles below Cairo, and Memphis, Tenn., a river length of about 200 miles. The present plans contemplate complete low-water channel regulation of this river reach. South of Memphis the need of complete regulation is not so pressing, and operations can be restricted to separate shallows and crossings and to the closing of secondary channels. In this work no radical change of channel course is contemplated. The plan is to train the low-water channel in a course of smooth easy curves that will depart the least amount from the present channel. The planned stabilized channel width is 3,300 ft., based on repeated observations in past years that in channel reaches exceeding this width bad navigation conditions are likely to be encountered.

Stabilization as planned, then, is the construction of works that will contract the channel and control the alignment. These works are generally spur dikes extending out-shore transversely to the channel and, in much smaller number, training works constructed longitudinally of the channel. In the following discussion these structures collectively are spoken of as contraction works.

Theory of contraction

The theory of stabilizing rivers for navigation by contracting the channel is as old as river engineering. In America contraction operations have been carried on in notable magnitude, chiefly on the Missouri River and on the Mis-

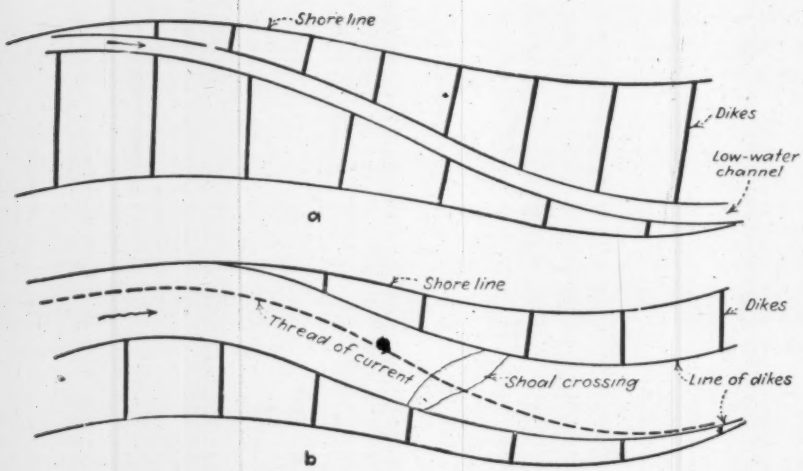


Fig. 2—Two methods of channel regulation at shoal crossings: *(a)* full contraction and *(b)* part contraction to concentrate scouring thread of current against bar.

sissippi River above Cairo (mouth of the Ohio River). The present work on the Mississippi south of the Ohio is a development from Missouri and upper Mississippi experience, as described in a succeeding section. The objective and general theory may be stated as follows:

So far as navigation is concerned, the improvement of the Mississippi is directed toward maintaining a channel 9 ft. deep and 300 ft. wide for 842 miles from Cairo, Ill., to Baton Rouge, La. Considered for this specific purpose, the undertaking involves a comprehensive consideration of hydrographic and hydrometric data amassed over long periods. On the lower Mississippi, however, regulation cannot be considered for the purposes of navigation alone. An important question of its effect on flood heights is involved. Spur dikes cause the bank line to build out about to the dike ends and to their tops, which are about 17 ft. above mean low water at the outer end. Eventually, it is expected, vegetation will grow on the extended banks, causing them to build up still more, perhaps to the elevation of the present banks. This contraction narrows the full-bank cross-section of the river and reduces the width of channel. To compensate for this decrease, the channel may deepen by scour and be hydraulically improved by its easy curves and even slopes.

All these effects are counted upon in the regulating project in progress. All are recognized as being of limited possibilities, however. It is unlikely that the regulated stretches will require higher levees to provide flood control equivalent to that obtained with the existing channel since the changes in cross-section are small as compared with the natural changes due to formation of bars and islands and willow growth. To what extent levee correction may be required is now the subject of study and observation.

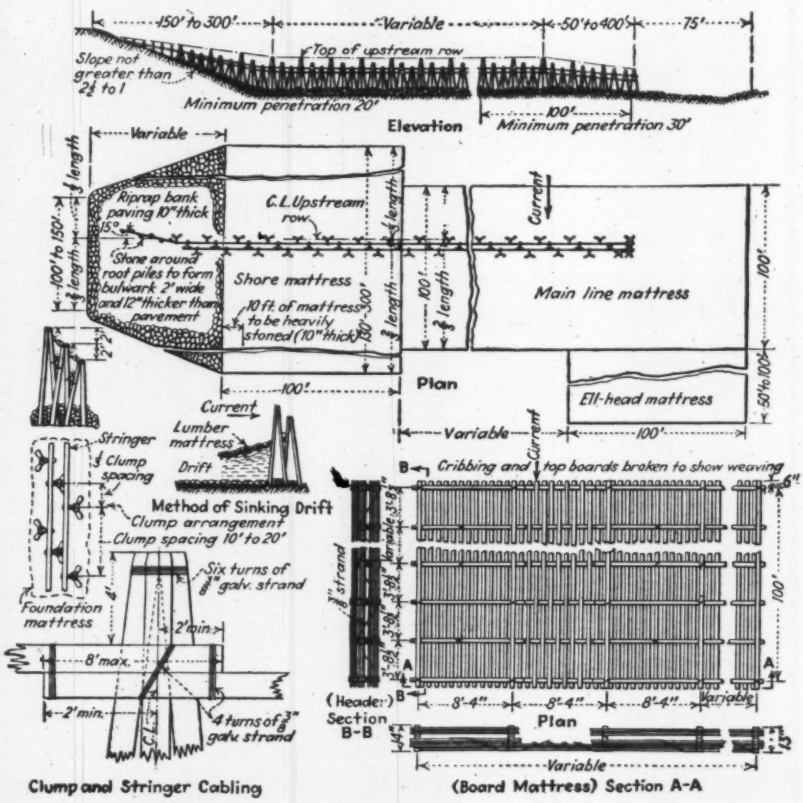
Contraction works design and construction on the lower Mississippi have drawn mainly on previous experience on the Missouri and upper Mississippi, to some extent on Arkansas River experience and on early experiments on the lower Mississippi itself. These early Mississippi experiments are of interest first, as their failure led directly to the channel-dredging policy followed for almost a generation prior to 1928.

Early Mississippi Examples—Actual construction of contraction works in the lower Mississippi River began with the organization of the Mississippi River Commission in 1879. They had, however, been recommended for trial in previous reports by army engineers connected with Mississippi improvement. At the time the M.R.C. took up its work, two river reaches—the Plum Point reach (mile 145 to 183) and the Lake Providence reach (extending 25 miles upstream from Lake Providence, La.)—presented bad navigation conditions, one with seven shoal crossings and the other with six. These reaches were selected for regulation. Between 1881 and 1884 two systems of spur dikes and training works were constructed.

The types of works constructed, shown by Fig. 1, were quite flimsy as compared with present standards. They gave some temporary help, but failed so quickly under the attack of the current and lack of adequate funds for maintenance, that they and their direct effect on the channel had disappeared by the early nineties. By 1896 the M.R.C. had virtually abandoned contraction works and turned actively to building up a dredging fleet and organization for maintaining navigable channels at crossings. These will continue to function until, as previously stated, the present regulating plans have shown the ability to perform the work for which they are planned.

Missouri River Examples—Experience in channel regulation on the lower Missouri contributed materially to practice on the spur-dike channel regula-

Fig. 3—Typical elements of standard spur-dike structure of the pile-clump type. The three-row dike is most used, but standards provide for two to six rows.



tion. It demonstrated a shoal-crossing technique particularly applicable to wide rivers with shifting soft bottoms, great variation in discharge and carrying a heavy load of sediment. This technique consists not in carrying the dikes out far enough to delineate positively the low-water channel, but in building them just far enough to throw a scouring thread of current across the shoal crossing. The two arrangements are indicated crudely by Fig. 2.

Permeable dikes proved entirely effective in the highly sedimented waters of the Missouri. Practice has settled down to two types of structure, the braced rows of pile clumps, as used on the Mississippi, and a braced pile-bent structure.

Upper Mississippi Example—The experience at Plum Point and Lake Providence as well as the marked efficiency and low cost of securing adequate channels with dust-pan type dredges turned the M.R.C. definitely away from the thought of contraction works for the lower river. Meanwhile, in the river from Cairo to St. Louis and farther north, such works were going ahead successfully. Only the practice south of St. Louis to Cairo, or between the mouths of the Missouri and Ohio, needs mention, as from it came the permeable pile dike, now virtually standard construction. In large degree probably, the St. Louis-Cairo dike type owed a debt to practice on the lower Missouri. However, its antecedents are too much confused to warrant seeking out; the important fact is that the permeable dike is the creation of the heavy silt-bearing streams of the Mississippi system south of the Missouri and including that river.

Structurally and in principle the permeable dike is a sediment-bearing river type. In the comparatively clear water of the Mississippi above the Missouri the solid dike or wing dam is essential structurally to hold the thin sediment load of the current and build out the river bank. The solid dike is necessary in all thinly sedimented streams; the fine sediment actually has to be held in order to build up bank extension in a reasonable time. But in the Missouri, the Arkansas and the Mississippi south of the Missouri the heavy sediment load had only to be retarded in order to start deposition. This current check is provided by the permeable structure, which at the same time gives the current passage through and reduces destructive eddy scour; it also is less expensive to build.

It may be mentioned here that in the early work at Plum Point and Lake Providence, previously mentioned, some actual evidence was had of the behavior of solid dikes when subjected to Mississippi currents. Among these contraction works were a solid brush and stone dam at Plum Point, a number of semi-tight abatis dikes and several sand dams. These all failed under the current attack except one or two, where fortuitous circumstances prevented full current action. Probably these early examples should not be taken as positive evidence that tight dikes will not endure the scouring currents of the lower Mississippi, but they indicate one reason why thinking turned so strongly to permeable-dike development.

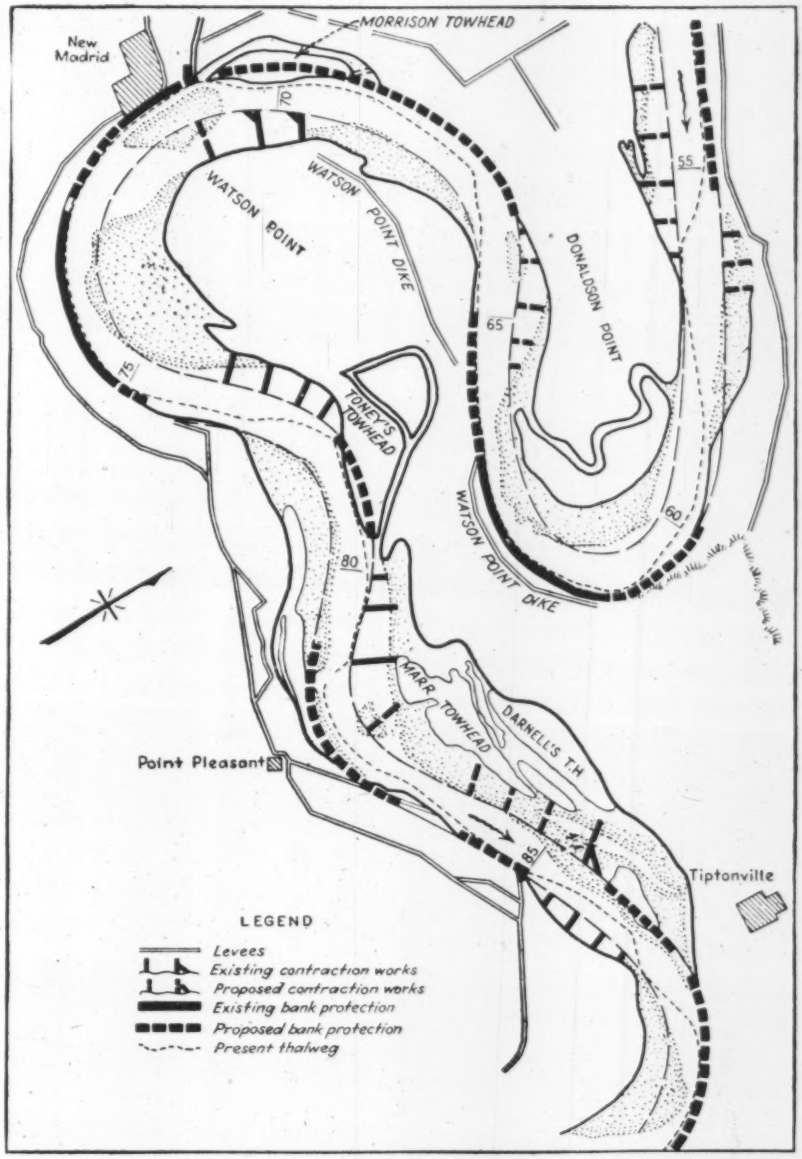


Fig. 4—River reach included in present project, showing characteristic elements of a channel-regulating operation involving contraction by dikes, bank protection by revetment and channel realignment in long easy curves.

In the several years' operation of regulating channel between the Missouri and the Ohio all the main elements of permeable-dike practice were developed: (1) a foundation or scour mattress of woven brush or boards covering the bank on the line of the dike; and (2) three or more rows of cable-hooped pile clumps staggered, driven through the mattress and braced together with waling. These elements were found to combine strength, resistance to scour and a check to the current without breaking its thread.

Conclusions of Experience—The records of contraction work on the Missouri and Mississippi prior to the present lower river project have been confined to a few outstanding facts. A circumstantial history would show many other trials in design and structure. From them all come the conclusion that in the early 90's the permeable dike became somewhat standardized along the general lines that are used today. This refers to a structure of three rows of piles in clumps. The present form for the Missouri River and the Mississippi below the mouth of the Missouri has two or more rows of piles in clumps of three, which are staggered and braced by longitudinal stringers between the rows. In exposed positions in deep

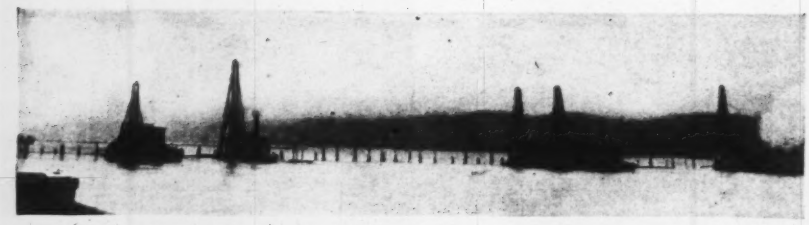


Fig. 5—Typical piledriving plant employed in the construction of spur dikes. The operation requires a large fleet of tow-boats, barges and quarter boats.

water below Cairo five to seven rows of clumps have been found to be necessary.

On the lower Missouri River all devices have been tried repeatedly, and retarding devices prevail. All early results are good on account of the heavy silt. In straight reaches and on convex sides of bends the dikes have been very generally successful. In slightly concave bends their success becomes problematic. In deep concave bends, under direct attack, their ultimate failure is almost certain.

On the lower Mississippi, where the river forces are greater, solid dikes are not effective or cheap, and no light structures of the permeable type are adequate. Only one type has come through without condemnation: that is the standard pile-clump dike. Changes are to be expected, but from a study of the experience it appears that they will remain standard practice, at least until some distinctly new idea is advanced.

A final general conclusion is that bank revetment is an essential element of all contraction work in curved reaches, and these prevail on the Mississippi where channel contraction is necessary.

New project planning

With types of works and general principles reasonably well determined by previous experience, the new project enlisted the aid of model experiments. Models of river reaches to be stabilized were constructed at the Waterways Experiment Stations at Vicksburg, and movable-bed tests were run with various arrangements of contraction works. These results were studied in relation with proved experience, and the works were then planned according to best judgment. Altogether, a score or more of model experiments have been conducted. In many cases they have produced evidence that has reduced dike construction and improved dike location and arrangement.

As stated previously, the project regulation plan between Hickman and Memphis does not call for radical change. Corrections of slope will be local only, and length of channel will be changed not more than a few miles in the 200-mile stretch. Realignment of channel is based on previous study of the radii of bends. This shows that serious caving occurred mostly in bends of 6,000- to 10,000-ft. radius, while in bends of 10,000- to 15,000-ft. radius the caving was only moderate. Where the radius exceeded 15,000 ft., however, the thalweg or thread of flow disclosed a tendency to wander, and channel deterioration followed. Wherever practicable, therefore, realignment has been on the basis of curves having between 10,000- and 12,000-ft. radius, increasing smoothly from the bight of the bend to the entrance and exit reaches.

The width of channel was set at 3,300 ft., as previously explained. This fixed the limits of the outer ends of dikes; original channel conditions then determined individual dike lengths. Elevation is a compromise of several factors. Accretion of fill is most rapid between mid-bank and full-bank stages, and the dike must be high enough to be effective at those stages. On the other hand, height increases the cost and decreases resistance to current attack. Balancing these factors, dike elevations equivalent to 20 ft. on the Memphis gage were adopted. Spacing has been a function of depth, direction and velocity of current and has varied from 600 to 5,000 ft.

Application of the principle indicated is exemplified by the planned operation shown by Fig. 4. The principal elements clearly observable are: close coordination of contraction works and bank revetment; holding the regulated channel continuously in the course of the present thalweg; smooth easy curving of the regulated channel to improve its hydraulic properties; and closing of diverting channels, such as the chute behind Morrison towhead.

Dike structures are generally of one design. The elements are: (1) foundation or scour mattress extending along

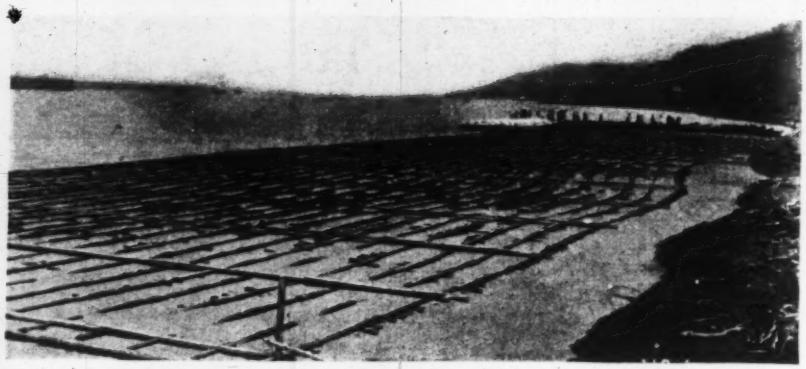
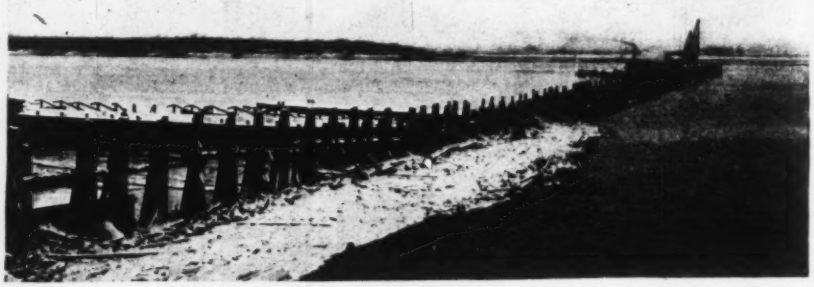


Fig. 6—Board mattress being sunk as foundation and to protect pile dike from scour. View shows mat being loaded with stone to sink it.

the line of the dike from bank top to beyond the tip of the dike; and (2) rows of hooped three-pile clumps extending outshore and braced together longitudinally by stringers. The construction is shown by Fig. 3.

Some details of the construction call for notice. The three piles of a clump are driven to form an equilateral triangle with 3- to 10-ft. sides, depending on water depth, and their tops are pulled together and hooped with steel cable to form a tripod giving lateral rigidity in all directions. All connections are steel cable ties—a waterman's construction calling for no framing and permitting retightening and retying by simple procedure. The piles are driven through the foundation mat, nailing it to the bank, and thick stone filling around the bottoms of the piles heals the holes in the mat and prevents suction scour. Where the dike has two or more rows of pile clumps, the clumps are staggered in alternate rows, and the elevations of successive downstream rows are stepped

Fig. 7—Spur dike approaching completion, showing accumulation of drift on upstream side. When accumulation becomes great enough, it is blanketed with a board mat and sunk, as indicated by Fig. 3.



down, dropping the successive lines of stringers, the whole arrangement increasing the lateral stiffness of the dike. The root and the tip of the dike are reinforced by riprap, additional mattress or additional pile clumps.

Construction methods are simple, although they involve heavy and extensive marine plant. Virtually all materials, including even the stone, must be brought from distant points. Tow-boat and barge fleets run to many units when work must be rushed to make the most of favorable river conditions. The mattress work calls for much hand labor, and the isolated locations call for quarter boats to house and feed workmen.

Fig. 5 illustrates a typical piledriving plant. Fig. 6 shows a board mattress being sunk by loading it with riprap from the stone barges shown at the far end.

Since the new project was started in 1928, about 170,000 ft. of dike structure have been constructed. This structure has cost from $15 to $50 a foot of dike, depending on the depth of water.

Catenary Steel-Plate Roof for Grain Elevator

Thirteen-million-bushel grain elevator at Albany, N. Y., has four shed-type roofs, each a 139x289-ft. steel plate of welded strips, suspended between longitudinal walls—Circular concrete bins built with sliding forms

IN STORAGE CAPACITY and in the design of the main roof areas the new elevator recently constructed at Albany, N. Y., by the Albany Port District is unique even among modern giant structures for trans-shipping grain. The 120 circular bins arranged in multiple-H plan (Fig. 2) have a capacity of 5,000,000 bu., and each of the eight rectanglar bins holds 1,000,000 bu., giving a total capacity of 13,000,000 bu. No other elevator of equal capacity is known.

The feature of the roof construction is that each pair of rectangular bins is covered by a shed-type roof of a single steel plate 289x139 ft., suspended as a catenary between two parallel walls to which its long edges are attached. The view (Fig. 1) shows one of these roofs completed. The only similar roof known is on an Omaha, Neb., elevator, but there the roofing plate is supported on suspension cables, while at Albany the plate is self-supporting. The erection of these large roof plates and the great volume and spread of the concrete work in the bins and walls called for construction methods and equipment of outstanding character.

General concreting methods

The concrete work consisted largely of outside and of circular-bin walls, of foundation mats for walls and bins, of certain underground conveyor galleries and of some girder work supporting the suspended roof. Except for the methods of concreting the circular-bin walls, no details of the methods are required. Fig. 2 shows the arrangement of the concreting plant. As the site was a filled-in marsh, 8,000 creosoted piles were driven for the bin and the other main foundation, and 3,500 untreated piles were driven to carry the conveyor galleries, the bottoms of which are below water. The main foundations consisted of heavily reinforced-concrete footings 2½ to 2¾ ft. thick set on the piles. All of the concrete for footings and galleries was carried from the mixing plant to the work in light trucks and chuted into the forms. This was in fact the method of haulage employed for all the concrete work.

The concreting plant consisted essentially of a materials-handling and mixing element and five hoist towers. Based on planned progress, a producing element was required having a capacity of 60 to 65 cu.yd. an hour. This was provided by two 1-yd. mixers. The sand and stone were proportioned by volume, and the cement by weight, using an ordinary platform scale. In general, materials were delivered as they were used. A 1,200-bbl. cement-storage house was provided, as shown by Fig. 2, but it was rarely used. Substantially the only storage was in the bins over the mixers. The aggregates were supplied by local

Fig. 1—One of four steel roofs for Albany, N. Y., grain elevator. Each roof is a single sheet of steel 139 ft. on the slope and 289 ft. long, suspended between parallel walls and made up of 74 strips each composed of six sheets, with all joints welded.

Fig. 2—General plan of Albany elevator, showing main elements and location of construction plant.

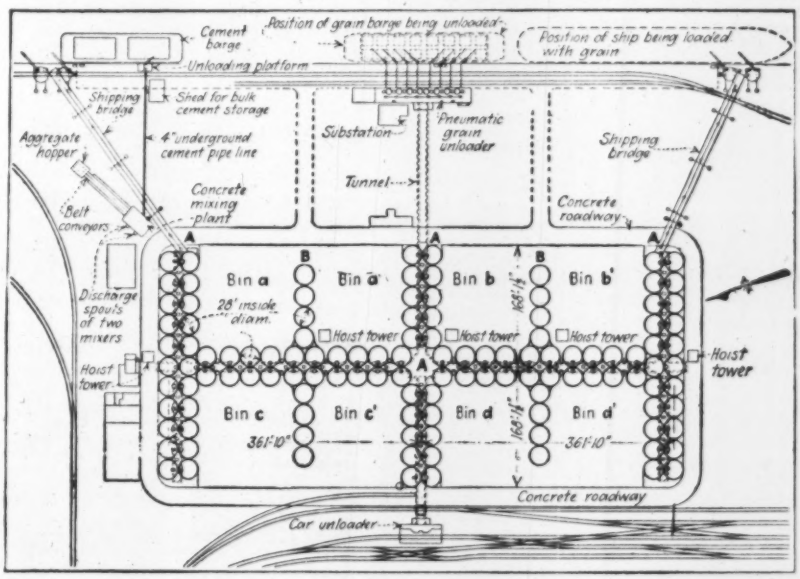


Fig. 3—Start of concreting on group of circular bins built simultaneously, showing yokes for sliding forms and working floor carried up with forms and serving as center for concrete-bin roof when top was reached.

dealers in trucks that dumped through traps onto a belt conveyor delivering to the bins. Cement brought in by barge was pneumatically conveyed direct into the mixer bin, which held 200 bbl.

Bin construction

The circular-bin arrangement is shown by Fig. 2. The longitudinal double row and the transverse double rows are 97 ft. high with 7-in. reinforced-concrete walls. The single-row bins being under the sloping roof (Fig. 1) are stepped down in height to correspond with the roof slope. All bins are 28 ft. in inside diameter. For concreting, the bins were divided into groups of about 20, and each group was served by a hoist tower (Fig. 2). The bin concreting in general conformed to usual sliding-form practice.

The arrangement for concreting the bins is well indicated by Fig. 2. The vertical jacking rods, one for each jack, had previously been set in the footing concrete. These were 1-in. rods 18 ft. long and were extended as the walls increased in height by coupling on additional rods and using a simple sleeve coupling. To begin, the inside and outside circular forms were plumbed on the footings, and the jacks were attached to them at the jacking rods, as shown by Fig. 3. Each form was a simple wood arc 4 ft. high, with 1x4-in. tongue-and-groove maple lagging set vertical and held by two rows of segmented waling

Fig. 6—Erection of roofing strip that had been fabricated on ground by welding together four steel sheets 31¼ ft. long, one 5 ft. long and one 10 ft. long.

Fig. 5—One of the steel-plate roof areas, showing top (*AA*) and bottom (*BB*) girders between which roof plate is suspended. The stepped-down bins are covered by the steel roof.

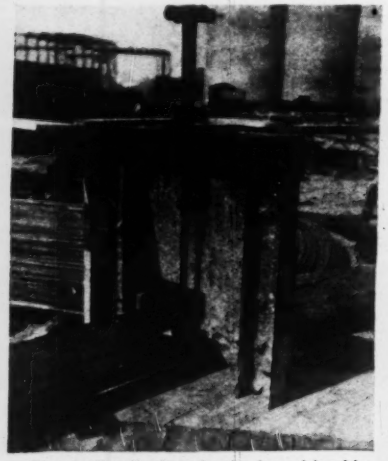
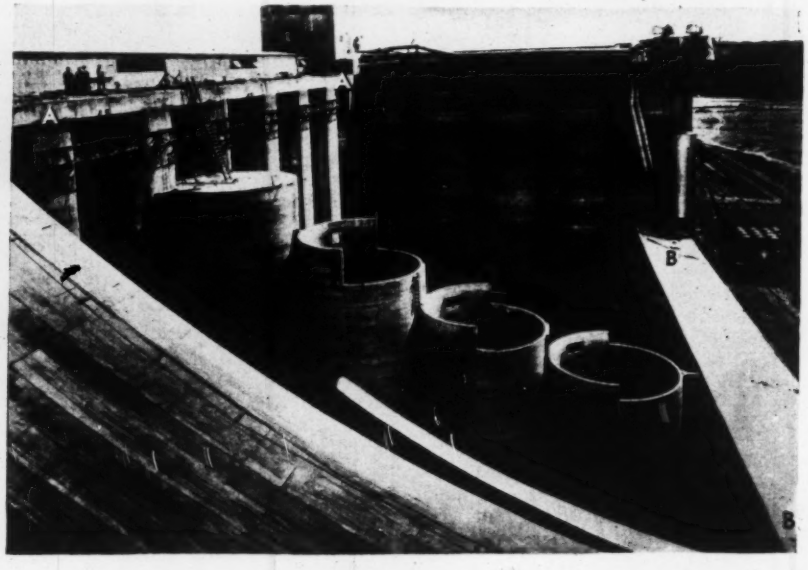


Fig. 4—Detail of steel yoke for raising bin forms. These yokes, given a half turn of the elevating nut every few minutes, raised the forms 9 in. an hour.



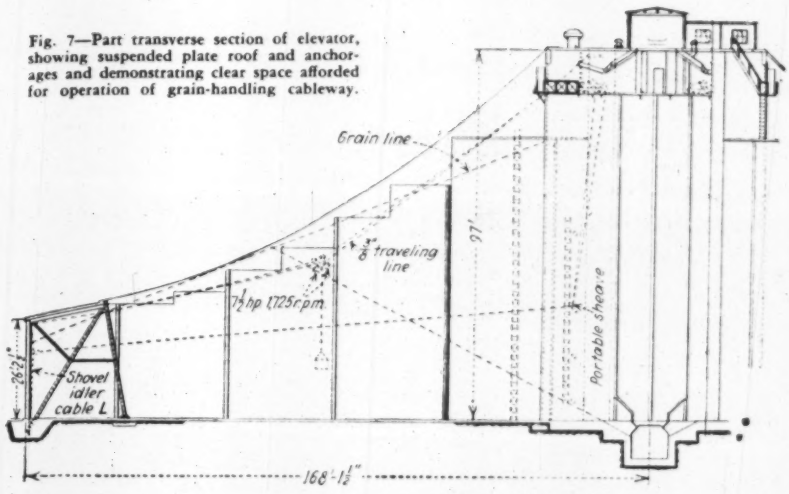


Fig. 7—Part transverse section of elevator, showing suspended plate roof and anchorages and demonstrating clear space afforded for operation of grain-handling cableway.

of three layers of 2x8-in. timbers. The two rows of waling were braced together by diagonal timbers. Steel trusses across the bin, carried by the inside form, supported a light floor. These floors, as shown by Fig. 3, moved up with the forms and provided the working platforms for placing concrete and steel. For each group of bins the working platform carried a stiff-leg derrick principally to handle steel. The jacks were of heavy steel construction operating in the usual manner, as shown by Fig. 4.

In operation the bins of a group (twenty or so bins) were concreted simultaneously. Concrete was brought by trucks from the mixing plant to the hoist tower, dumped into the hoist bucket and raised to the tower hopper above the working platform level. From the tower hopper the concrete was chuted to a floor hopper and then to concrete buggies for distribution to the forms. The concrete pour for a group of bins ran about 7,500 cu.yd. and was completed in about 153 continuous hours (6 days, 9 hours). The forms were moved up continuously, one man operating eighteen jacks, traveling his round continuously and giving each jack a half turn of the screw as he reached it. The rate of upward travel of the forms was about 9 in. an hour, or 17 ft. per 24-hour day. Five men aided the form operators by changing the jack collars as necessary and extending the jacking rods. When the forms had risen to the bin tops, the floors served as centers for concreting the bin roofs. During the rise of the forms they were kept plumb by checking the levels of the working floors. To permit easy sliding, the two forms were pitched in ⅜ in. at the top.

Catenary-roof erection

While the circular bin construction and that of the elevator house and conveyor galleries conformed in general to familiar practice, the roofing of the rectangular bins called for unique procedure. One of the four completed roofs is shown by Fig. 1. Each of these roofs covered a pair of bins as *a* and *a'* in Fig. 2. To permit this, the single-row bins *B*, *B* were stepped down as shown by Fig. 5; all double-row bins were 97 ft. high. To form separated bins, as *a* and *a'*, the stepped concrete bins are carried up to the under side of the roof by steel extensions.

Each of the four roofs is a single plate of steel suspended between girder *AA* and girder *BB* (Fig. 5). Each bin is therefore entirely clear of obstructions between walls and from floor to roof plate. The purpose of the suspended-plate roof design was to secure this complete clearance first so that there would be no hindrance to slackline bucket mechanism (Fig. 7) for handling the grain, and second so that the bins could be used better for merchandise or other material when not required for grain. The plate roof also was computed to be somewhat less expensive than structure of a more normal type.

The roof structure is best understood from Figs. 5, 7, 8 and 9. As shown by Fig. 9, the roof plate is made up of 12-gage steel sheets welded into a continuous plate. The breaks at expansion joints are only apparent as they are covered by an inverted V-plate, the legs of which are welded to the roof plate proper. This great sheet of steel is suspended as shown by Figs. 7 and 8 to girder *A* at the top level of the longitudinal double row of bins, and to girder *B* carried by trapezoidal anchor frames. Referring to Fig. 9, each roof strip as *aa*, *bb*, is made up of six sheets, four of which are 31¼ ft. long, one 10 ft. and one 5 ft. By alternating the 5- and 10-ft. end strips the joints in alternate plates are staggered. Most of the strips are 50 in. wide, but 53-, 39-, 38-, 35- and 19-in. strips were used as required to make up the over-all roof dimensions.

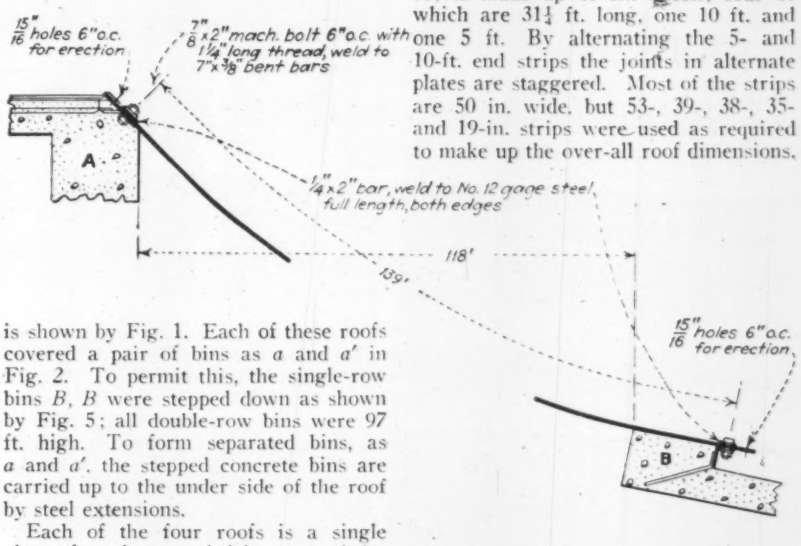
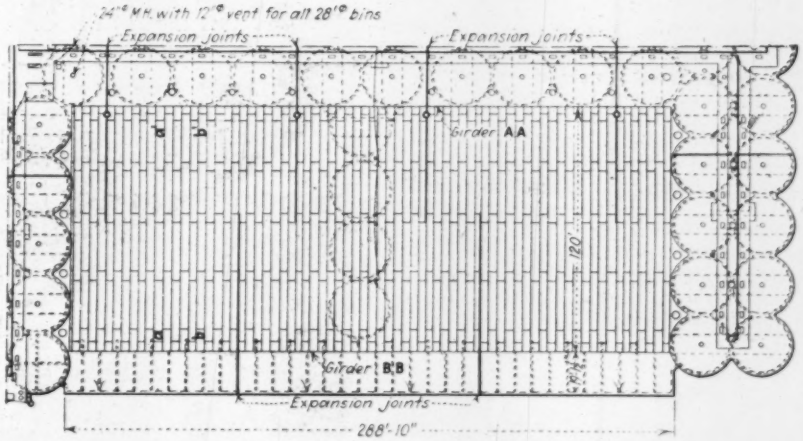

15/16" holes 6" o.c. for erection
7/8" x 2" mach. bolt 6" o.c. with 1¼" long thread, weld to 7" x 3/8" bent bars
A
¼" x 2" bar, weld to No. 12 gage steel full length, both edges
118'
139'
15/16" holes 6" o.c. for erection
B

Fig. 8—Detail of ridge and eaves anchorages for steel-plate roof.

Fig. 9—Plan of steel-plate roof, showing arrangement of component sheets, welded joints and expansion joints. Each roof was made up of 444 separate sheets.



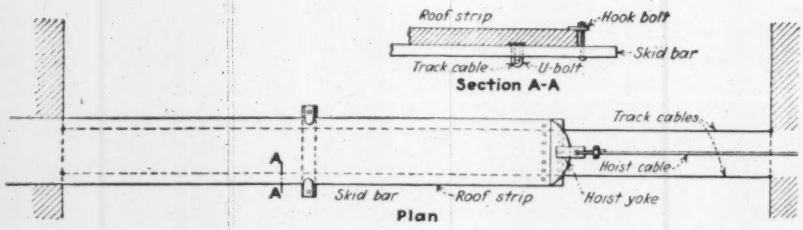


Fig. 10—Sketch showing arrangement for hauling roof strip into place on a track of suspension cables.

The strips were welded on a steel platform on the ground, all joints being butt-welded except the last at the top, which was lap-welded to give greater strength and also to permit final adjustment in the length of the strip. Each strip has two rows of drilled holes across each end, one row for erection and one for permanent anchorage, as shown by Fig. 8.

The strips were erected one at a time, first the under strips properly spaced, and then the overlapping upper strips. In erecting an under strip (Fig. 6), first a steel ramp was erected from the ground, and then, in line, two track cables from the lower to the upper anchor girder. A hoist yoke was bolted to the endmost row of holes at the top end of the strip, and a cable from the yoke ran to a hoist on the bin roofs. In hoisting, the strip rode up on the ramp and track cables until the lower anchor-bolt holes were in position for bolting. To keep the strip on the track cables, skid bars (Fig. 10) were clamp-bolted to it at intervals as the hoisting progressed. These skid bars carried underhung U-bolts that embraced the cables, and they were removed from the roof strip after it was anchored. The upper roof strips were hoisted riding on the lower strips on board skids, arranged much like the skid bars used for the under strips. The roof strips were anchor-bolted at the bottom and then at the top. Welding then proceeded.

First the strips were tack-welded at 10-ft. intervals to hold them in adjustment. Tack welds were then made at 4-ft. intervals, and finally the joints were continuously welded. All welding was by the shielded-arc process, using eight 200-amp., 60-20-volt direct-current generators. The welding rods were ⅛ in. covered electrodes in 14-in. length. About 7,500 lb. of electrodes was required for 55,000 ft. of fillet-welding. The welding crew consisted of five men welding the roof strips on the ground, one man making 10-ft. tack-welds, two men making 4-ft. tack-welds and two men fillet-welding. The welding crew worked two shifts from 5 a.m. to 1 p.m. and from 1 p.m. to 9 p.m. A roof plate was welded complete after erection of the strips in nine days.

Supervision

In charge of the project for the Albany Port District Commission were Arnold G. Chapman, chief engineer, and R. L. Holt, construction engineer. H. G. Onstad, vice-president, was in general charge of design and construction for the James Stewart Corp., general contractors. Paul C. Metz, superintendent, directed field operations for the general contractor. Erection and welding of the steel roofs were carried out under the direction of J. A. Klevens, president, and E. H. Methlie, vice-president, of the J. K. Welding Co., Inc., New York City.

Small Concrete Bridge Simulates a Timber Structure

Lyons Mill Bridge in Rock Creek Park, Washington, D. C., is a three-span continuous T-beam structure with corbeled girders and hand-rails stained with creosote, and iron fittings

By D. H. Gillette
Assistant Director, Buildings and Public Parks of the National Capital, Washington, D. C.

A SMALL concrete bridge, designed to give the appearance of a timber structure and thus harmonize with its wooded surroundings, has been completed for a bridle path in the Rock Creek and Potomac Parkway in Washington, D. C. Such bridges generally fail to have the desired appearance because the designer's attention has usually been confined to the imitation of the surface detail of wood. The theory behind the design of the Rock Creek bridge was that the general form and mass would suggest wood but that no attempt whatever would be made to imitate the surface detail of wood. The accompanying photograph shows the completed bridge, whose location is indicated in the lower right-hand corner of the map on p. 381, *ENR*, Sept. 29, 1932.

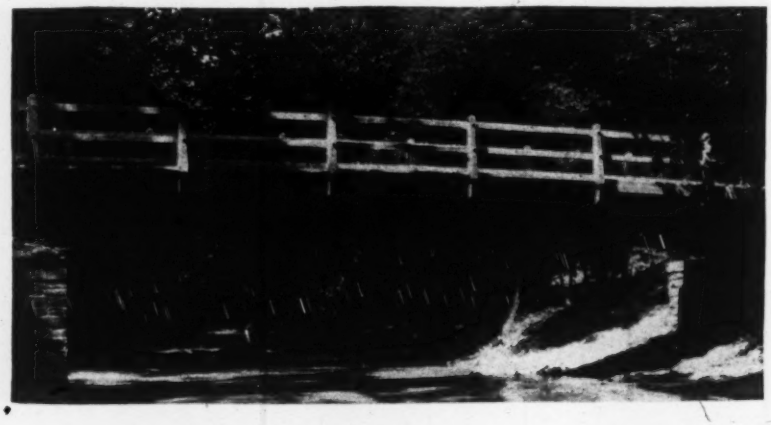
There has been a bridge of some kind at this location since about 1800, the original one having been constructed of wood with two stone piers, the total length being about 100 ft. Constant difficulty in maintaining this crossing arose from the flashy nature of Rock Creek. The channel pier was carried away many years ago, and a timber bent was substituted. Since 1900 the bridge has twice been destroyed by the failure of this timber bent under drift jams. The last occurrence of this kind was in 1930, at which time it was decided to reconstruct the bridge in concrete and to omit the channel pier so as to avoid further possibility of drift collection.

To the casual observer the new structure is immediately interpreted as wood bridge, and it is only upon close inspection that the true nature of the material shows itself. Five elements were deliberately introduced into the design to contribute to the appearance of timber. These are:

1. The suggested corbels on the under side of the girders.

2. The iron brackets and bolts in the hand-rail, which actually serve the purpose of holding the members in place.

Fig. 1—A timber structure in harmony with its setting is suggested by this concrete structure in Washington, D. C.



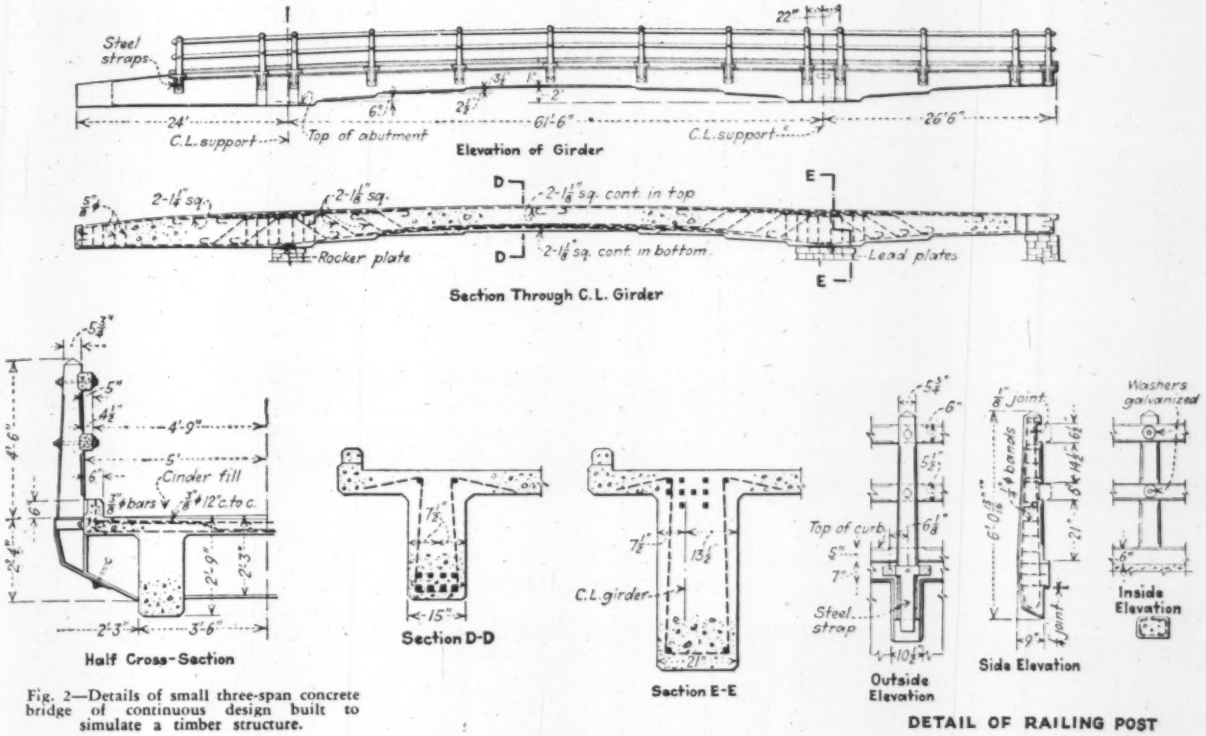


Fig. 2—Details of small three-span concrete bridge of continuous design built to simulate a timber structure.

3. The slimness of the members in the hand-rail.

4. The chamfering of the hand-rail and the suggested corbels.

5. The staining of all exposed concrete with a brownish creosote stain.

The hand-rail is unusually light, and in addition the structure was designed as a three-span continuous T-beam. This type of design permitted the 62-ft. center-span girders to be only 2 ft. 9 in. deep at mid-point, or 1/22 of the span, as compared with 1/10 or 1/12 which is common for most concrete bridges.

Although intended primarily to carry only a bridle and foot path, the bridge actually is capable of carrying ordinary automobile traffic so as to permit park refuse, etc., to be hauled out over it. Also it could be widened to any desired extent merely by adding similar units alongside the existing one.

The bridge was designed in the Office of Public Buildings and Public Parks of the National Capital, the detailing being done under the direction of John L. Nagle.

Letters to the Editor

Simple Safeguard for Night Drivers

Sir—By inadvertently smashing the right spectacle of a pair of yellow sun glasses I was amazed to find that if I wore the remaining glass for night driving the lights from oncoming motor cars did not bother me at all. The right eye sees the right side of the road and the left eye is not dazzled by bright headlights. The odd part is that the right eye, too, seems to be more or less oblivious of lights and yet can pick out objects on the highway distinctly.

Curious to learn why this should be, I tried the glasses on in daylight. I found that I saw yellow with both eyes.

It seemed as if at night there might be a dimming of the vision sufficient to cause an accident. To ascertain this, I drove my car for over an hour through a Saturday night crowd on a busy main street in Ohio and found no evidence of loss of vision. On the contrary, such protection is most comfortable on eyes and nerves.

My suggestion to those who dislike night driving because of bewildering lights is to buy themselves a 10c. pair of yellow glasses *that fit*, and remove the right spectacle. Practice for fifteen minutes on back streets to get the hang of it. Then go forth and forget the other fellow, for he will no longer bedevil you.

JOHN S. CRANDELL,
Professor of Highway Engineering, University of Illinois.

Urbana, Ill.,
July 16, 1933.

Shallow-Deck Bridges

Sir—In your issue of June 15 Earle W. Meckley takes exception to a discussion of mine on Mr. Meckley's design for a shallow-deck bridge (*ENR*, April 6, 1933, p. 430). To substantiate the remarks made in his reply, Mr. Meckley has brought forth two points not mentioned in his original article—namely, that the bridge in question was subject to overflow from the stream beneath, and also that future widening of the bridge was considered. In his original article on the design of this bridge he stated, "Calculations and studies showed that in order not to restrict the flow of the stream it would be necessary to provide for a clear waterway of not less than 1,000 sq.ft." From this statement I inferred that no design for overflow had to be provided for. However, my plate-girder design with 12-in. rolled-section floor beams will give more than 1,000 sq.ft. of waterway.

As to the matter of future widening, I do not agree with Mr. Meckley's statement that the deck structure of plate-girder design would have to be scrapped. The type of plate-girder bridge shown in my article of May 11 can be readily widened by changing to a three-girder double-roadway bridge. This change can be made without wasting any of the original deck material and usually with little, if any, interference with traffic during alteration. Of course, when such change is made, the middle girder would have to be reinforced to carry the reaction from the double-roadway systems unless this provision had been taken care of in the original design.

ARTHUR N. DOUD.

East Cleveland, Ohio,
June 21, 1933.

Engineering News-Record

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AUGUST 3, 1933 Volume 111 No. 5

The Construction Code

A CODE of fair practice, regulating wages, hours of work and business policies for the entire construction industry was completed and presented to NRA on Aug. 1. The news will come as a surprise to those who maintain that there is no such thing as a construction industry in the sense that there is a steel or a textile industry. It will prove something of a shock to those engineers and architects who maintain that a profession is not an industry and must not be considered as such. It will be disappointing to the individualists and to any groups who hope to maintain their own particular brand of autonomy. It will provide a rude awakening to any who have not yet sensed the fact that the industrial fabric of this country is being subjected to a sweeping and basic reorganization, both in form and in function. But with the passing of the surprise and the shock will come realization of a great accomplishment. For the first time, all the diverse elements of construction are united in a common cause. Such a union was envisioned by those who sponsored the road and building congress in Detroit last winter. It has been the primary objective of the Construction League and of predecessor organizations. But previously the theoretical advantages of cooperation have not been recognized widely enough to bring union about. The construction code gives the movement both force and authority.

Power Contracts First

EXPENDITURE of $63,000,000 to develop power at the Grand Coulee site on the Columbia River will be difficult to justify under any of the limitations set up to keep the money provided by the Recovery Act from being squandered. It is all very well to say that the electricity that will be produced there will be the "cheapest in the country," but with the market already oversupplied with electricity that statement can mean but one thing—namely, that a market for this current is to be found by destroying the market of existing plants. If that policy is to be followed, the government can find justification for the expenditure of much more of the money by going into the Pittsburgh district and building a modern steel plant that can undersell the existing plants. Alluring as the Grand Coulee project is as a great engineering undertaking, its construction should not be undertaken simply to satisfy the very natural desire of the residents of the state of Washington to see this long-hoped-for $400,000,000 combined power and irrigation scheme brought nearer to realization. Work on the project should not be started until contracts for enough of the power to justify the expenditure are available. This criterion was set up when the southwestern region was promoting the construction of Boulder Dam, a project with incomparably greater justification because of its flood-control features. It must be maintained if the federal government is to be kept from wasteful expenditure of its funds.

A Sharp Distinction

THE DISTINCTION between spending public money for projects like the proposed power development on the Columbia River, which produce a marketable commodity, and those which are essentially community facilities and do not compete with private industry cannot be too sharply drawn if the Recovery Act is to continue to receive public support generally. Before the former are undertaken there must be a clear showing of a need not now satisfied by private initiative and unquestioned evidence that the project will be able to stand on its feet financially. In the case of community facilities, on the other hand, there must be a clear showing of its necessity but the project need not be self-supporting. Grade-crossing elimination, for example, never will bring a direct return on the investment, and yet it is a class of work that finds ample justification under the Recovery Act. The reason for this is clear; such work adds to the general welfare of the community without imperiling private investments prudently made in community service. The object of the public-works section of the Recovery Act is to provide the impetus for business recovery through an increase in construction work. It must not be used as a guise under which to put the government into destructive competition with private industry.

A Novelty in Roofs

SHEETS of steel 139x289 ft., hung up by the long edges between two parallel wall girders of the Albany grain elevator, are described in this issue and are unique even among the curious roof structures in which engineering has been prolific. Structural simplicity in the use of steel for roofing large areas appears at about its maximum in this construction. With the resources of modern welding to draw upon, steel-roof erection became a hardly more complex operation than the sewing and spreading of a canvas awning. No supporting centering and no scaffolding were required, and no men worked from the under side; all operations were from the top of the sheets, which themselves carried the welders and their light equipment. Welding technique was concerned chiefly in bringing the edges of the sheets into contact for the long continuous weld and in preventing creeping in the 139-ft. lap welds. These were accomplished by using spot welds first at 10-ft. and then at 4-ft. intervals, and then filling the gaps. Few roofing operations have called for fewer accessories and processes, fewer workmen or less equipment.

Draw-Bridge Openings

THE WAR DEPARTMENT is to be congratulated on its recent ruling in the long controversy between land and water traffic over the opening of draw-bridges. In the New Jersey section of the New York metropolitan district, where the railroads in recent years have elevated many of their important river crossings to give an underclearance of 35 ft. over the navigable channel, the department has ruled that under stated restrictions

land traffic is to have the right-of-way over tug boats that have not lowered their masts and stacks to below the 35-ft. level. That level was fixed some years ago as being one to which tugs and similar vessels could be required to lower their upper works without sacrifice of efficiency. It is proper, therefore, now that ample time has been allowed for making the change, that those vessel operators who prefer not to make the change should be required to await the convenience of the railroad in the opening of draw-bridges.

The Main Objective

APPOINTMENT of the regional administrators and state advisory boards, which are to be important elements of the directing organization for the public-works program, brings to an end seven weeks of anxious waiting. During this period the program was attacked as unnecessary because business had already improved; it suffered from a series of whittlings on the part of all federal departments whose regular appropriations Congress had cut; it met organizational difficulties; and it was all but lost sight of in the concentration of thought on the regimentation of industry in the interest of shorter hours, higher pay and fairer competitive practices. But we are now once again on the right road to recovery. From this point forward the main objective—large-scale re-employment—must be kept constantly and clearly in mind.

Industry has been diligent and remarkably successful in organizing its affairs to comply with the needs of the times. It is necessary to remember, however, that all of these activities, under Title I of the Recovery Act, are of a preparatory nature. Industry is merely putting on a clean collar and tidying up the place to be ready for the paying guest. Codes of fair practice will be of little use if the present speculative business volume is not stabilized and supported by the purchasing power of the public-works program provided for under Title II.

Public works from now on assume major importance. On the shoulders of the men comprising the regional and state administrative organizations for local public works rests one of the gravest responsibilities that this or any other federal administration has ever delegated. Theirs is the task not only of approving or rejecting projects that eager sponsors put forward but of stimulating local governmental bodies to immediate action. "Their job," said Secretary Ickes, the national public-works administrator, "is to move men from relief rolls to payrolls."

Sound technical knowledge, sympathetic understanding, financial acumen, fair and disinterested judgment and driving power are essential for this task. It is difficult to estimate the capacity of the various boards in the light of such severe requirements. The few men whose names are familiar in the public-works field are without exception excellent choices. As for the others, who constitute the majority, it is fair to assume that they too appreciate and understand the task at hand and possess the ability to carry it through, indeed, one can hardly conceive that the President otherwise would have intrusted to them the attainment of the most vital objective of his program.

The responsibility of the central public-works board is no less real and is perhaps the more urgent because the regional and state organizations can be of little effect unless they are immediately equipped with adequate power to act. If all authority remains centered at Washington, if the local agencies are made mere relay stations for the headquarters organization, the intensive progress that is essential will not be possible; only through effective decentralization and delegation of authority can a repetition of the disastrous R.F.C. fiasco be avoided. In seeing that such authority is provided, the directing authorities at Washington have a supreme responsibility, the more urgent because of the seven weeks' time already lost out of the heart of the working season.

It is not the purpose here either to praise or to question the appointments of the regional administrators or the state advisory boards. It is not the purpose to carp over the unexplained delay in getting started or to try to place the blame. Cooperation and encouragement, and not criticism, are what is needed. But the responsibility that all of these men in positions of authority have to the nation should be emphasized at this time. It is proper to remind the newly appointed officials that at least a billion dollars in contracts should be let by October. It is proper also to urge all engineers, public officials and citizens to give them every assistance. For unless all of this is done there will be little use for the high order of industrial discipline that is being set up. Unless it is done, unemployment will stalk the country for another winter.

The public-works machinery for creating employment will be complete as soon as the vitally important PWA state engineers are appointed. It must be made to run.

New Work, New Opportunity

THE CHANGING aspect of the railway engineer's work is nowhere more apparent than in the record of subjects discussed at the Chicago meeting of the American Railway Engineering Association. In the early years of that organization the interests of civil engineers in railway service were divided between construction and maintenance, and maintenance work was confined largely to continuing the construction operations by strengthening and solidifying the roadbed, widening cuts and fills and maintaining temporary structures. Operating and economic problems were of little moment to maintenance engineers.

Now interest has come to center on maintenance problems related directly to operating economy. When Wellington wrote his monumental work, the economics of railway location was the most active question in this field. But today the engineer is occupied largely with such problems as proper distribution of labor gangs, substitution of machines for hand labor, and methods of increasing the service life of rails, ties and ballast, all of which make a direct showing on the balance sheet of his division.

The result is advantageous both to the division and to the engineer himself. The engineer's field of activity is broadened, and if he has natural executive ability he can step out of the rut in which so many railroad engineers of the past have found themselves as the amount of new construction began to dwindle. Not a few engineers have made the step from engineering to operating official—the late Sir Henry Thornton was an outstanding example—and coming years should see more making the same change. The activities forced upon the railroad engineer by the needs of the service have also opened up new doors of opportunity.

NEWS OF THE WEEK

Construction Code for Entire Industry Submitted to NRA

A GENERAL code for the entire construction industry was adopted August 1 and submitted to NRA with a request that it be accepted as superseding the President's blanket code, pending formal hearings. The general code was framed at the suggestion of Malcolm Muir, deputy administrator of NRA, by a committee of the Construction League of the United States in a two-day meeting with representatives of all branches of the industry, and will be supplemented by codes prepared by the various sub-divisions such as architects, engineers, contractors subcontractors, materials producers, fabricators and distributors.

The code establishes 40c. as the minimum hourly wage, an average work week of 35 hr. during any six-month period, with a maximum of 48 hr. a week and 8 hr. a day. It is understood that the provision with respect to hours of labor was suggested by NRA as preferable to the provision in the tentative code, as drafted by the League's committee, for a maximum of 40 hr. a week but not more than 150 hr. a month.

As a voluntary code offered as a substitute for the President's blanket code, the construction code becomes effective upon the individual immediately upon signature by him, and as an industry code will become compulsory when signed by President Roosevelt. But none of its provisions is retroactive and it applies only to new contracts.

Before the code was submitted to NRA a provision was inserted prohibiting bid peddling and providing that all supplemental codes should contain provisions to enforce this rule.

Because of opposition to the code committee's proposal that the League's policy committee should select an industrial control committee of eight members, it was finally decided that the policy committee itself should serve as a National Industrial Administrative Committee, including three members to be appointed by NRA. This course was adopted because of lack of time in which to set up a representative committee on any other basis. It is hoped that formal hearing on the code will be scheduled within two weeks and that such supplemental codes as may be drafted by that time will be heard at the same time. Supplemental codes will not be held up until all have been filed. It was regarded as impractical to fix a date by which all supplemental codes should be filed.

The personnel of the policy committee until the next election, January 1, is as follows:

Alonzo J. Hammond, consulting engineer, Chicago; E. J. Russell, Mauran, Russell and Crowell, architects, St. Louis; A. P.

(Continued on page 148)

New York Provides Funds For Barge Canal Improvements

Under the terms of a bill passed by the senate of the New York legislature, a revolving fund of $10,200,000 immediately becomes available for improvement of the New York State Barge Canal. Of this amount $200,000 will be used for purchase of rights of way for straightening curves and $150,000 is to be used f engineering surveys and administrative e penses.

The project is to be part of a $27,500,00 canal program which the state is seekin to have the federal government approve a part of its public works program.

The new measure is designed as an un employment relief project. It was d sired to set up a state revolving fund s that work could be begun at once.

Policies and Organization of PWA Place Engineers in Key Positions

RULES and regulations, enunciating policies and setting forth procedure, were made public on July 31 by the Federal Emergency Administration of Public Works. The rules, issued as Circular No. 1, available from the government printing office, Washington, D. C., deal with (1) purposes, policies and organization; (2) loans to private corporations; (3) housing, and (4) applications heretofore made to the RFC. As finally set up, the Public Works Administration is non-political in operation although numerous non-technical men have been appointed as regional advisors and as members of state advisory boards. A glance at the organization chart will reveal, however, that the function of the state advisory boards is merely to propose and that, thereafter, political considerations will not prevail against the judgment of competent engineering personnel.

An engineer will be assigned by the Public Works Board to each state. All projects brought forward in each state will be routed to Washington through him. In Washington they will be received and passed upon by the director of non-federal projects and referred to a technical board of review before action is finally taken. The "State Engineer (PWA)," as he is called, will be the executive officer of the state advisory board and will organize its office and employ and direct its personnel.

Labor policies

The labor policy laid down in the rules declares that public works jobs shall be equitably distributed among qualified workers who are unemployed. Lists of workers for public works projects are to be supplied by agencies of the United States Employment Service, but highly skilled or organized labor shall not be required to register and shall be obtained, subject to certain restrictions, through recognized trade union locals.

The 30-hr. week is established as far as practicable and feasible. Working time unavoidably lost can be made up. Where a sufficient amount of labor is not available in the immediate vicinity of the work, 130 hr. of work per month will be permitted. On remote projects, where camps are necessary for all the labor, 8 hr. per day and 40 hr. per week may be permitted.

In addition to stating minimum wage rates in all construction contracts, such minimum rates also shall be stated in the advertisements for bids and in all proposals of bids submitted, including those of subcontractors.

There shall be no provision in any contract providing for price differentiations or for restricting the use of materials to those produced within the Nation or State, provided, however, that preference shall be given to the use of materials produced under codes of fair competition if prices, quality and quantity available are satisfactory to the Administrator or Governmental agency executing the contract.

Eligibility of projects

The rules provide tests for eligibility of projects. The Administrator, State Advisory Board and State engineer, under the Public Works Administration, will apply the following tests in determining the eligibility of each project submitted:

1. The relation of the particular project to coordinated planning, and its social desirability.
2. Economic desirability of the project, i.e., its relation to unemployment and revival of industry.
3. The soundness of the project from an engineering and technical standpoint.
4. The financial ability of the applicant to complete the work and to reasonably secure any loans made by the United States.
5. The legal enforceability of the securities to be purchased by the United States or any lease to be entered into between the applicant and the United States.

Preference will be given to (1) projects integrated with and consistent with a State plan rather than to the isolated or inconsistent; (2) projects which can be started promptly rather than to those requiring delay, and (3) projects near centers where unemployment is serious.

The rules provide that the following classes of projects will be preferred as to the grant, and in the following order for purposes of the immediate program, i.e., those projects that can be started within 30 days:

1. Waterworks projects not unduly burdening the community with debt and necessary for its health and convenience.
2. Sewer projects of the same character.

3. Sewage-disposal projects sufficiently comprehensive to render a river or lake system, used by many communities, safe as a water supply, and other sewage-disposal projects.

4. Other projects, which like the foregoing, are regenerative, i.e., tend to stimulate further projects, such as highways, bridges and tunnels, opening of new territory for homes and industry, projects for the transmission of electrical energy into territories not now served.

Financing

The President, in determining whether to allow or withhold a grant, will also consider to what extent the budget of the applicant is balanced or in process of balancing and will prefer those public bodies which put their finances in order.

The United States will bid, par and accrued interest, for bonds to finance projects of public bodies approved by the Administrator, provided the bonds bear interest at the rate of 4 per cent. Bonds and obligations under contract on lease are to be annually amortized pursuant to state statutes and according to the life of the project but not to exceed 30 yr., except for such projects as obviously have a longer life and in no case to exceed 50 yr.

Organization

The rules provide for a decentralized organization of the Public Works Administration with centralized control. Provision is made for a planning board which is to advise and assist the Administrator in the preparation of the comprehensive program of public works required by law. There also is provision for a labor board, which will function in cooperation with the Department of Labor, and a technical board of review to which will be referred projects approved in principle by the Administrator but of an unusual character and involving difficult questions of engineering, finance or law. To this board also will be referred controversial projects for the hearing of objectors.

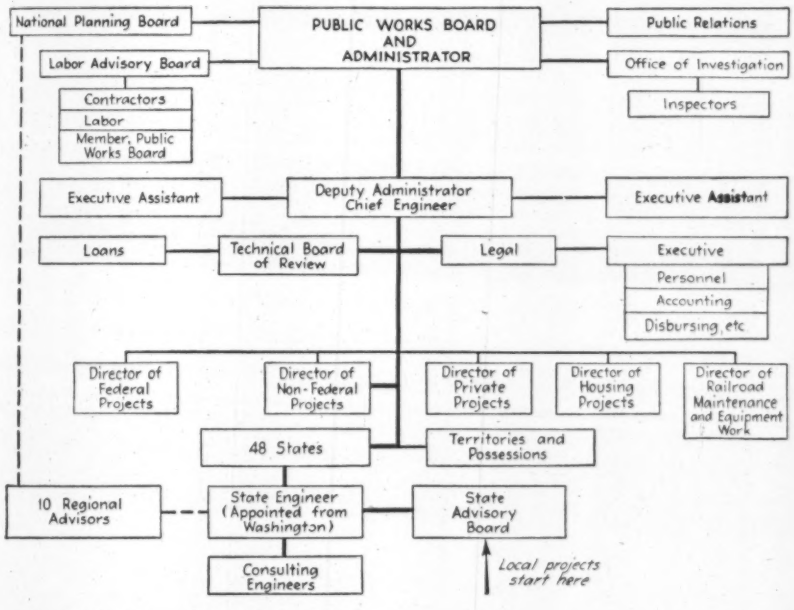
The field organization will be composed of ten regional advisors, 48 state advisory boards and a public works engineer in each state, and their necessary staffs.

The state engineer (PWA), appointed by the Administrator, will be the executive officer of the state advisory board, will organize its office, receive, record and examine all applications for projects and report to the state advisory board on each. This engineer will be a federal agent. When an application (in four counterparts) is received and recorded the engineer will examine it and ascertain whether it includes all necessary engineering, financial, legal and other information and will elicit further information if necessary. Upon completion of examination the engineer will submit the application to the state advisory board and the board to Washington with its recommendation.

The regional advisers will assist the national planning board to formulate a plan for each region and will stimulate public interest in regional and general planning.

Private projects

Part 2 of the rules and regulations pertain to loans to private corporations, other than for housing. Because of the diverse and varied nature of possible loans to private corporations, no standardized form of application blank will be issued. Applications should be addressed to the appropriate State Advisory Board in four counterparts.



Organization chart of Public Works Administration (P.W.A.) based on information in Circular No. 1 as to principal positions and lines of authority.

Housing

Part 3 of the regulations deals with housing. The law provides for low-cost housing and slum-clearance projects under public regulation or control. Grants may be made to public bodies having the power to undertake housing projects directly, in aid of such projects and either in conjunction with, or independently of, loans to them. Even though such bodies do not have the power to undertake such projects directly, they may assist such projects by the construction of adjacent parks, playgrounds, etc., in aid of which they would be eligible for a grant as well as a loan.

No housing loans will be made which cannot be safely self-liquidated during the useful life of the building. For the purpose of making application interest may be assumed at 4 per cent and amortization at 35 yr. on fireproof and 25 yr. on non-fireproof buildings, but these are subject to adjustment. Application for housing loans are to be made directly to Washington.

RFC projects

Part 4 deals with applications heretofore made to the Reconstruction Finance Corporation. The resolution adopted by the Special Board of Public Works in this respect reads: "The Administrator will not consider applications for loans on any project which stood approved by the Board of Directors of the Reconstruction Finance Corporation as of June 26, 1933.

"Should the said Board hereafter rescind its approval of any such project, the applicant may then make application for aid in financing the project through the appropriate State Advisory Board."

Columbia River Dam at Grand Coulee Financed by NRA

CONSTRUCTION of a dam at the Grand Coulee site on the Columbia River at an estimated cost of $63,000,000 as part of the public works program under the Recovery Act was approved by President Roosevelt on July 28. It is proposed now to build the dam only to part of its ultimate height and to install 700,000 hp. of power generating equipment.

The Grand Coulee dam is the key to the Columbia Basin project, a combined power and irrigation development costing about $400,000,000. In the complete project it is proposed to build a 370-ft. high dam across the Columbia River near the upper end of the Grand Coulee, to use part of the power developed at the site to pump water up into a storage reservoir formed by damming both ends of the coulee (a prehistoric river channel) and to use that water to irrigate 1,200,000 acres in the Columbia Basin. About 1,000,000 primary horsepower and 1,000,000 secondary power can be developed at the site. Pumping would require 660,000 hp.

Many reports have been made on the proposed development. The most recent ones were by the U. S. Bureau of Reclamation (*ENR*, June 30, 1932, p. 907) and by the Corps of Engineers, U. S. Army, as part of a report on the entire Columbia River (*ENR*, July 14, 1932, p. 52).

Recently a contract was signed between the Columbia Basin Commission of the State of Washington and the U. S. Bureau of Reclamation under which the bureau will make topographic surveys, study sources of material for concrete aggregates, explore the foundations by drilling and test pits, prepare designs and estimates for the dam, prepare plans and specifications for construction and investigate the market for power. It is proposed now to build a dam 145-ft. high with a power installation of 700,000 hp. Its foundations will be designed for a dam of a height of 370 ft. The expenditure contemplated under the contract is $377,000.

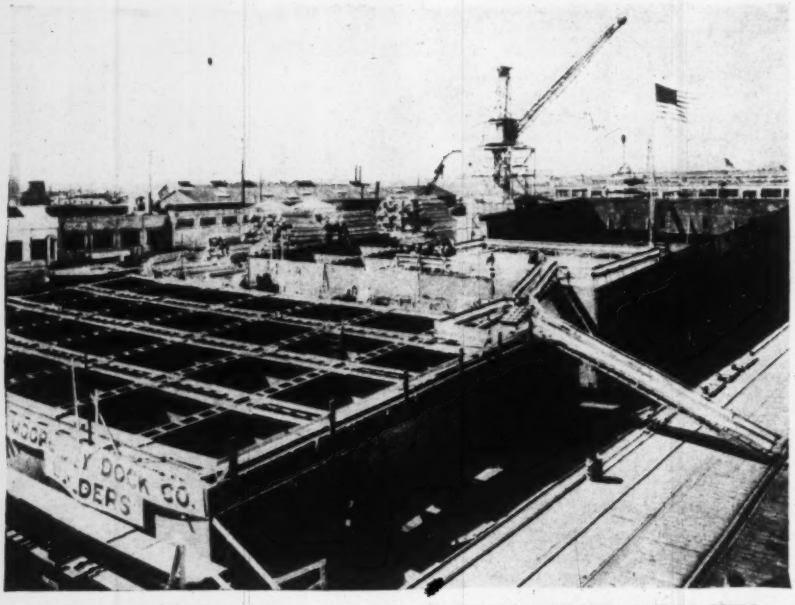
Study of a Code for All Engineers Begun at New York

IN conformity with the expressed desire of the National Recovery Administration that all units of the construction industry that may be considered as coming within the provisions of the Recovery Act be prepared to submit codes as supplements to a general code for the construction industry, George T. Seabury, secretary of the American Society of Civil Engineers, on Aug. 2, called an informal conference of representatives of the principal engineering organizations concerned with construction to discuss a code for professional engineers. Invitations to participate were sent to the national societies of the mechanical, electrical, mining and chemical engineers, to the American Association of Engineers, American Engineering Council, American Railway Engineering Association, American Institute of Consulting Engineers, American Water Works Association, American Concrete Institute and to numerous local and regional engineering organizations.

Subjects discussed at the meeting were the desirability of setting up a code for professional engineers under the Recovery Act, matters to be covered by such a code when prepared, definitions of the professional and sub-professional groups to be considered, and the relation of the engineers code to the codes of other professional groups in the construction industry.

To assist in directing the discussion at the meeting into definite channels, Carlton S. Proctor, New York, recently appointed to head up the code work for the American Society of Civil Engineers reported on the studies already made by him in connection with representatives of other interested engineering organizations, with architects and general contractors and presented a tentative draft of a code for engineers prepared as a result of those studies.

E. J. Russell, president of the American Institute of Architects, on Aug. 1, announced the appointment of a committee to prepare a code for the architectural profession. William S. Parker, Boston, is chairman of that committee. This committee already has prepared a code for the architectural profession. Mr. Proctor reported that as a result of discussions between this committee of architects and the engineers both codes had been altered materially from their original form, that many concessions had been made by both sides by mutual agreement in order to bring the two codes into close conformity, and that points upon which they could not agree had been referred to the code committee of the Construction League for a decision. The architects expect to submit their code to the code committee in a few days and Mr. Proctor urged prompt action by the engineers.



COFFERDAM CUTTING EDGES FOR SAN FRANCISCO-OAKLAND BRIDGE PIERS

On July 26 the steel cutting edge of the cofferdam for Pier No. 6, the east pier of the West Bay crossing of the San Francisco-Oakland Bridge, was launched at the plant of the Moore Dry Dock Company. This cutting edge 74½x127 ft. and 13½ ft. deep is shown in the foreground of the view above while behind it is the 92x179x 17½ ft. cutting edge for the huge central anchorage of the two suspension bridges.

These cutting edges will be founded on rock at 170 and 180 ft. below low water level. The caissons of which they are a part are of special design developed by Moran & Proctor, consulting engineers, New York. The walls of these cofferdams are to be of two layers of timber, an inner lining of 10x12's placed vertically and an outer lining of 4x12's placed diagonally. Inside of the cofferdam, 21-in. wide-flange section wales and 8-in. wide-flange section struts set both ways, on 10 ft. centers vertically, comprise the bracing. In each of the pockets formed by the cross-bracing, steel dredging cylinders 15 ft. in diameter are to be installed. By caping the cylinders and placing them under air pressure it is possible to control the flotation of the cofferdams at all stages of sinking and to give them exceptional stability.

Washington Notes

By Paul Wooton
Washington Correspondent

Federal projects undertaken by the Public Works Administration will be on a grand scale, if the allotment of $63,000,000 for Grand Coulee dam on the Columbia is an index. After the board had foundered around for several weeks, President Roosevelt stepped in and its policy now seems to be taking tangible form. Without waiting to see how the President's vast scheme of social economy in the Tennessee Valley develops, a similar experiment will be undertaken in the Columbia River basin. Details of the project are reported elsewhere.

Resumption of dredging for the 9-ft. channel in the Upper Mississippi has been authorized by the President as this is regarded primarily as a navigation project. The President has refused, however, to earmark $150,000,000 for the St. Lawrence seaway, in anticipation of ratification by the Senate of the treaty with Canada. His stated reason is that holding back money for future work would not serve the purpose of the public works program, which is to support industrial recovery by creating employment.

Secretary Ickes announced that the Budget Bureau had agreed to release the appropriation of $21,000,000 appropriated by Congress for Mississippi flood control work that had been held back by budget director Douglas with the idea that it might be subtracted from the emergency public works fund.

The public works administration has decided that it cannot do anything for the contractors on the New Orleans bridge or the Los Angeles aqueduct that are now confronted with a demand for higher rates. Secretary Ickes said these R.F.C. projects cannot be reopened without inviting pleas for similar relief on many other contracts.

Further Allotments Made From Public Works Fund

The Cabinet Advisory Board on public works on July 27 made an allotment of $10,850,620 from the public works fund. The War Department was allotted $6,000,000 of that amount, to be utilized for coast defense and harbor improvement. "Construction, renovation and modernization of the coast and harbor defense arrangements" in the Panama Canal Zone were allotted $4,000,000 and $2,000,000 were assigned to Hawaii.

The remainder of the allotment, $4,850,620, went to the Department of Agriculture to be used in combatting plant parasites throughout the country, including the gypsy moth, white pine blister rust, black stem rust of wheat, oats, barley and rye and Dutch elm disease.

Allotmen of $22,700,000 for the Casper-Alcova project, $11,500,000 for the upper Mississippi 9-ft. channel, $15,982,745 for the forest service, $2,600,000 for the Coast & Geodetic Survey, $2,400,000 for topographic mapping and $100,000 for a survey of ground water resources by the Geological Survey was announced by Secretary Ickes Aug. 1. This brings the total allotment for federal projects, exclusive of the Naval building program, up to $152,072,555.

Advisory Board For Each State Announced by PWA

APPOINTMENT by President Roosevelt of the Advisory Board to administer the public works program of the National Recovery Act was announced on July 26. Boards of three members were named for each state, with four for Texas, to form the framework of a decentralized public works organization. The State Advisory Boards are to organize at once and to submit to the public works administration at Washington the local projects that they recommend.

An early duty of the board will be to submit to the administrator an immediate state program. In the states where such programs already have been approved by official agencies, the State Advisory Board will re-examine the projects before submission to the administrator. Local government projects which are not approved by State Boards will not be considered at Washington.

The Public Works Administration has stated that its aim is to create an organization which will allow low overhead costs. It is planned to keep the administrative cost to within a fraction of 1 per cent of the funds. Public Works Administrator Ickes has written to all state governors calling upon the state to furnish the public works administration with quarters for the State Advisory Board. The states and other public bodies will be asked to make any of their facilities desired by the public works administration available without additional expense to the government.

The State Advisory Boards will be paid on a $10 per diem basis for each member, with pay only for the days that they are actually engaged in public works administration tasks. They will also be allowed subsistence at $5 per day while away from home. The ten regional advisors already appointed will be given a salary of $6,000 per year.

Each state is to be provided with an engineer, appointed by the federal administrator and responsible to him. This engineer will be the executive officer of the state board and the technical expert. He will organize the board's office, direct its small personnel and receive, record and examine all applications made for projects and report to the board on each. These men will be known as the State Engineers of the Public Works Organization, but will be federal agents directly responsible to Washington headquarters.

The advisory boards are as follows:

ALABAMA

Milton H. Fies—Birmingham.
Mayer W. Aldridge—Montgomery.
Fred Thompson—Mobile.

Mr. Fies is a mining engineer. Mr. Aldridge is an accountant and Mr. Thompson a publisher and former Commissioner of the U. S. Shipping Board.

ARIZONA

William Walter Lane—Phoenix.
Leslie G. Hardy—Tucson.
Moses B. Hazeltine—Prescott.

Mr. Lane is state engineer of Arizona. Mr. Hardy is an attorney and former assistant attorney general of Arizona. Mr. Hazeltine is a banker.

ARKANSAS

E. C. Horner—Helena.
Haley M. Bennett—Little Rock.
John S. Parks—Fort Smith.

Mr. Horner is an attorney and a recognized authority on flood control. Mr. Bennett is active in the cotton industry. Mr. Parks is an editor and a member of the State Highway Commission.

CALIFORNIA

Hamilton H. Cotton—San Clemente.
Franck Havenner—San Francisco.
E. F. Scattergood—Los Angeles.

Mr. Cotton is manager of large estates and a business man. Mr. Havenner, a supervisor of San Francisco. Mr. Scattergood is an engineer and manager of Public Utilities Bureau, Los Angeles.

COLORADO

Thomas A. Duke—Pueblo.
Morrison Shafroth—Denver.
Miss Josephine Roche—Denver.

Mr. Duke was Administrator of the Park System of Pueblo, city commissioner and in the fruit and produce business. Mr. Shafroth is an attorney. Miss Roche is a coal operator and a welfare worker.

CONNECTICUT

John J. Pelley—New Haven.
Archibald McNeil—Bridgeport.
Harvey L. Thompson—Middletown.

Mr. Pelley is a railroad executive. Mr. McNeil, publisher of several papers. Mr. Thompson is a business man, who has served as State Senator.

DELAWARE

Lee Layton—Dover.
Will P. Truit—Milford.
Wm. Speakman—Wilmington.

Mr. Layton is a graduate engineer and proprietor of a large wholesale grocery. Mr. Truit is a business man and a fruit and grain broker. Mr. Speakman is a plumbing equipment manufacturer.

FLORIDA

C. B. Treadway—Tallahassee.
W. H. Burwell—Miami.
T. L. Buckner—Jacksonville.

Mr. Treadway is chairman of the State Road Department. Mr. Burwell is an attorney and Mr. Buckner a consulting engineer.

GEORGIA

Thomas J. Hamilton—Augusta.
Arthur Lucas—Atlanta.
Ryburn Clay—Atlanta.

Mr. Hamilton is an editor. Mr. Lucas has been active in civic affairs in Atlanta and Mr. Clay has been an Atlanta banker.

IDAHO

Beecher Hitchcock—Sandpoint.
Frank E. Johnesse—Boise.
Edward C. Rich—Boise.

Mr. Hitchcock is a business man and manufacturer. Mr. Johnesse is a mining and construction engineer and former superintendent of road construction. Mr. Rich has been in the grocery business.

ILLINOIS

Carter H. Harrison—Chicago.
James L. Houghteling—Chicago.
James H. Andrews—Kewanee.

Mr. Harrison is a lawyer who served five terms as mayor of Chicago. Mr. Houghteling is a newspaper executive and banker. Mr. Andrews is a lawyer, Mayor of Kewanee and president of the Illinois league of municipalities.

INDIANA

Lewis G. Ellingham—Fort Wayne.
Charles B. Sommers—Indianapolis.
John N. Dyer—Vincennes.

Mr. Ellingham is a publisher, banker and former Secretary of State of Indiana. Mr. Sommers is a manufacturer and Mr. Dyer is a farmer.

IOWA

Harold M. Cooper—Marshalltown.
W. F. Riley—Des Moines.
W. P. Adler—Davenport.

Mr. Cooper is a manufacturer of automobile specialties. Mr. Riley is an attorney. Mr. Adler is publisher of six newspapers.

KANSAS

R. J. Paulette—Salina.
Martin Miller—Fort Scott.
Ralph Snyder—Manhattan.

Mr. Paulette is a graduate engineer of the University of Missouri, formerly a director of public works at Salina, served overseas with U. S. Army Engineers and an active member of a number of other business associations. Mr. Miller is a banker and former mayor of Fort Scott. Mr. Snyder is president of the State Grange.

KENTUCKY

Wylie B. Bryan—Louisville.
N. St. G. T. Carmichael—Kyrock.
James C. Stone—Lexington.

Mr. Bryan is a business man and head of a hardware company. Mr. Carmichael is a business man who has served on many boards and commissions in the state. Mr. Stone is former Chairman of the Federal Farm Board and president of a tobacco cooperative.

LOUISIANA

James E. Smitherman—Shreveport.
Edward Rightor—New Orleans.
James W. Thomson—New Orleans.

Mr. Smitherman is an attorney. Mr. Rightor is a New Orleans civic leader, and Mr. Thomson is a leading newspaper publisher.

MAINE

James M. Shea—Bar Harbor.
John Clark Scates—Westbrook.
William M. Ingraham—Portland.

Mr. Shea is a retired contractor. Mr. Scates is a retired banker and former member of the Maine House of Representatives. Mr. Ingraham is a former probate court judge of Cumberland county, former mayor of Portland and Assistant Secretary of War under President Wilson.

MARYLAND

J. Vincent Jamison—Hagerstown.
W. C. Stettinius—Baltimore.
Charles E. Bryan—Havre de Grace.

Mr. Jamison is a manufacturer and a member of the Hagerstown city council. Mr. Stettinius is a business man and a manufacturer. Mr. Bryan is a business executive.

MASSACHUSETTS

John J. Prindaville—Framingham.
Alvin T. Fuller—Boston.
James P. Doran—Brockton.

Mr. Fuller is the former Governor of Massachusetts. Mr. Prindaville is a manufacturer. Mr. Doran is attorney and special Justice of the Bristol District Court.

MICHIGAN

Murray D. Van Wagoner—Pontiac.
Frank H. Alford—Detroit.
Leo J. Nowicki—Detroit.

Mr. Van Wagoner was formerly engineer of the Michigan State Highway Department, a drainage commissioner of Oakland county and State Highway Commissioner. Mr. Alford is a railroad executive. Mr. Nowicki a drainage commissioner of Wayne County, an engineer who was retained for construction work by the Soviet Union.

MINNESOTA

John F. D. Meighen—Albert Lea.
Fred Schilplin—St. Cloud.
Wm. N. Ellsberg—Minneapolis.

Mr. Meighen is a former district judge, who served as Minnesota Crime Commissioner. Mr. Schilplin is a civic leader in the St. Cloud community. Mr. Ellsberg is Commissioner of Public Highways and former city engineer of Minneapolis.

MISSISSIPPI

Hugh L. White—Columbia.
Horace Stansell—Ruleville.
Birney Imes—Columbus.

Mr. White served for several years as mayor of Columbia and has been in public works development. Mr. Stansell and Mr. Imes have been active in civic affairs in their districts.

MISSOURI

William Hirth—Columbia.
Harry Scullin—St. Louis.
Henry S. Caulfield—St. Louis.

Mr. Hirth is a farm leader and head of a large cooperative farm marketing and processing organization. Mr. Scullin is a manufacturer and has been active in Missouri relief work. Hon. Henry S. Caulfield is former Governor.

MONTANA

James E. Murray—Butte.
Raymond M. Hart—Billings.
Peter Peterson—Glasgow.

Mr. Murray is an attorney and banker. Mr. Hart is a business man and former president of the Billings Chamber of Commerce. Mr. Peterson is a State Senator.

NEBRASKA

John Latenser, Jr.—Omaha.
John G. Maher—Lincoln.
Dan V. Stevens—Fremont.

Mr. Latenser is a architect, engineer and builder and former president of the engineer's club of Omaha. Mr. Maher is former president of an insurance company and an active business man. Mr. Stevens is a banker and a former member of the House of Representatives and superintendent of schools in Dodge county.

NEVADA

Robert A. Allen—Carson City.
William Settlemeyer—Elko.

Ed. Clark—Las Vegas.
Mr. Allen and Mr. Settlemeyer are engineers. Mr. Clark is a business man and banker in Southern Nevada.

NEW HAMPSHIRE

Harold Lockwood—Dartmouth College.
Robert C. Murchie—Concord.
Mr. Lockwood is an engineer in the Thayer Engineering school of Dartmouth, has assisted in handling government construction. Mr. Murchie is a lawyer. The third appointee, Stanton Owen, an attorney of Laconia, died on July 28.

NEW JERSEY

Edward J. Duffy—Teaneck.
William E. White—Red Bank.
Walter Kidde—Montclair.
Mr. Kidde is a retired engineer and a former member of the State Highway Board. Mr. White is a former mayor of Red Bank. Mr. Duffy is a business man and a graduate of Columbia University.

NEW MEXICO

J. D. Atwood—Roswell.
Henry G. Coors, Albuquerque.
Felipe Sanchez y Baca—Tucumcari.
Mr. Atwood is an oil producer, Mr. Coors an attorney and Mr. Baca a merchant, all active in civic affairs.

NEW YORK

Peter G. Ten Eyck—Albany.
John T. Dillon—Buffalo.
Paul M. Mazur—New York City.
Mr. Ten Eyck is a former Congressman who has held many other public offices. Mr. Dillon is head of several engineering companies and a banker. Mr. Mazur is a banker.

NORTH CAROLINA

Dr. Herman G. Baity—Chapel Hill.
John Devane—Fayetteville.
Frank Page—Raleigh.
Dr. Baity is a Dean in the School of Engineering at the University of North Carolina. Mr. Devane is a business man. Mr. Page is an engineer and banker, former Chairman of North Carolina State Highway Commission.

NORTH DAKOTA

Henry Holt—Grand Forks.
Stephen J. Doyle—Fargo.
Thomas Moody—Williston.
Mr. Holt is a business executive who served as a Chairman of the Governor's Committee on Public Works. Mr. Doyle is a business man who served as United States Marshal for North Dakota under Woodrow Wilson. Mr. Moody is a publisher.

OHIO

Wm. A. Stinchcomb—Cleveland.
Rufus Miles—Columbus.
Henry Bentley—Cincinnati.
Mr. Stinchcomb is an engineer who served as director and manager of the Cleveland Metropolitan Park Board. Mr. Miles is Director of the Ohio Institute and expert on municipal laws and finance. Mr. Bentley is an attorney.

OKLAHOMA

John H. Carlock—Ardmore.
Frank C. Higginbotham—Norman.
Walter A. Lybrand—Oklahoma City.
Mr. Higginbotham served as city manager of McAlester and Sapulpa, Okla. Mr. Carlock is a former State Senator. Mr. Lybrand is a lawyer and trustee of the Oklahoma Foundation on Public Welfare.

OREGON

Bert Haney—Portland.
C. C. Hockley—Portland.
Robert N. Stanfield—Baker.
Mr. Haney is a former member of the U. S. Shipping Board, former United States District Attorney of Oregon. Mr. Hockley is an engineer. Mr. Stanfield is former United States Senator.

PENNSYLVANIA

Joseph C. Trees—Pittsburgh.
A. E. Malmed—Philadelphia.
J. Hale Stineman—Lancaster.
Mr. Trees is a Trustee of the University of Pittsburgh and an oil and gas operator. Mr. Malmed is a manufacturer. Mr. Stineman is a newspaper publisher.

RHODE ISLAND

Hon. William S. Flynn—Providence.
John Nicholas Brown—Newport.
William E. Lafond—Woonsocket.
Hon. William S. Flynn is an ex-Governor of Rhode Island, and a former member of the Rhode Island House of Representatives. Mr. Brown is a financier and Mr. Lafond is a banker and business man.

SOUTH CAROLINA

L. P. Slattery—Greenville.
Burnet R. Maybank—Charleston.
Thomas B. Pearce—Columbia.
Mr. Slattery is an engineer. Mr. Maybank is a business man, mayor of Charleston. Mr. Pearce is a business man and has served as Public Utilities Investigating Committee Chairman.

SOUTH DAKOTA

Leon P. Wells—Aberdeen.
Herbert E. Hitchcock—Mitchell.
S. H. Collins—Aberdeen.
Mr. Wells is former State Highway Commissioner. Mr. Hitchcock is an attorney and State Senator. Mr. Collins is head of the contractors' association.

TENNESSEE

Col. Harry S. Berry—Nashville.
Roane Waring—Memphis.
W. Baxter Lee—Knoxville.
Mr. Berry is an engineer, formerly a State Highway Commissioner, a West Point graduate and served in the Army in the Philippines, Mexico, and commanded an artillery regiment overseas during the World War. Mr. Waring and Mr. Lee are attorneys and leaders in civic affairs.

TEXAS

Col. Ike Ashburn—Houston.
S. A. Goeth—San Antonio.
John Shary—Mission.
R. M. Kelly—Long View.
Mr. Ashburn is a business executive with an excellent military background who has been administrator of various important appointments. Mr. Goeth is an attorney and Mr. Kelly is a business man and manufacturer. Mr. Shary is one of Lower Rio Grande Valley's leading citizens.

UTAH

Wm. J. Halloran—Salt Lake City.
Ora Bundy—Ogden.
Sylvester Q. Cannon—Salt Lake City.
Mr. Bundy, a former major in the United States Army Engineering Corps, and mayor of Ogden. Mr. Halloran is a leading business man. Mr. Cannon is an engineer of large experience.

VERMONT

Frank H. Duffy—Rutland.
P. E. Sullivan—St. Albans.
Lee C. Warner—Bennington.
Mr. Duffy is a former commissioner of public works of Vermont and a banker and business man. Mr. Sullivan and Mr. Warner are active business men.

VIRGINIA

Henry G. Shirley—Richmond.
J. Winston Johns—Charlottesville.
Richard Crane—Westover.
Mr. Shirley is State Highway Commissioner of Virginia and former President of the American Association of State Highway Officials. Mr. Johns is a retired business executive. Mr. Crane is former president of the Crane Valve Company of Chicago, a diplomat who served as United States minister to Czecho-Slovakia and has long been active in public affairs.

WASHINGTON

William A. Thompson—Vancouver.
C. W. Greenough—Spokane.
Roy LaFollette—Colfax.
Mr. Thompson is a transportation executive and President of Vancouver Chamber of Commerce. Mr. Greenough is prosecuting attorney of Spokane County. Mr. LaFollette is an attorney.

WEST VIRGINIA

D. H. Stephenson—Charleston.
William P. Wilson—Wheeling.
Van A. Bittner—Fairmont.
Mr. Stephenson is a business man, and formerly a member of the State Legislature. Mr. Wilson is a manufacturer and lumberman. Mr. Bittner is a regional official of the United Mine Workers and a labor leader.

WISCONSIN

Walter G. Caldwell—Waukesha.
Wm. G. Bruce—Milwaukee.
John Donaghey—Madison.
Mr. Bruce is a publisher, who served on the Milwaukee school board, Milwaukee Harbor Commission and as tax commissioner. Mr. Caldwell is an engineer and Chairman of the Highways Commission. Mr. Donaghey is a civil engineer and State Highway Engineer.

WYOMING

Patrick J. O'Connor—Casper.
Leroy E. Laird—Worland.
John W. Hay—Rock Springs.
Mr. O'Connor has served in the State Senate and Legislature. Mr. Laird was formerly superintendent of the State Highway Department. Mr. Hay is a banker.

Inclusive Code Prepared for Construction Industry

(Continued from page 144)

Greensfelder, Fruin-Colnon Contracting Co., St. Louis; J. C. Bebb, assistant to vice-president, Otis Elevator Co., New York; P. W. Donoghue, P. W. Donoghue Co., plumbing contractors, Boston; Merritt Harrison, architect, Indianapolis; W. G. Luce, vice-president, Hegeman-Harris Co., builders, New York; A. E. Horst, secretary-treasurer, Henry W. Horst Co., engineering contractors, Philadelphia; Oscar A. Reum, plastering contractor, Chicago; F. W. Morse, eastern manager, Chamberling Metal Weatherstrip Co., New York; F. P. Byington, general manager, architects service dept., Johns-Manville Corp., New York; Lion Gardner, Lakewood Engineering Co., equipment manufacturers, Columbus, Ohio; C. G. Conley, the Mt. Vernon Bridge Co., steel fabricators and erectors, Mt. Vernon, Ohio; Charles G. Fanning, cut stone contractor, Chicago; E. J. Mehren, president, Portland Cement Association, Chicago; Herbert S. Crocker, consulting engineer, Denver; T. H. Cutler, chief engineer, Missouri State Highway Commission, Jefferson City.

The complete text of the code of fair competition for the construction industry, "embracing the elements of design, general contracting, subcontracting and supply," was as follows:

To effectuate the policy of Title I of the National Industrial Recovery Act during the period of the emergency, the Construction League of the United States, a membership organization of national trade associations and professional bodies, pursuant to the purpose of the construction industry to cooperate with the President of the United States, submits for approval, pursuant to Section 3 of the said Title, the following Code of Fair Competition and plan for its administration for all construction work. It shall be supplemented by codes of fair competition to be submitted by the various representative national trade associations and professional bodies.

1. The Construction League of the United States imposes no inequitable restrictions to membership therein, and is truly representative as a national organization of the Construction Industry.

2. This Code will not promote monopolies or eliminate or oppress small enterprises and will not operate to discriminate against them and will tend to effectuate the policy of said Title I. It is expressly recognized that the President of the United States may, as a condition of his approval of this Code, impose such conditions (including requirements for the making of reports and the keeping of accounts) as may be expedient in the furtherance of the public interest for the protection of consumers, competitors, employees, and others, and may provide such exceptions to and exemptions from the provisions of this Code as the President of the United States in his discretion deems necessary to effectuate the policy herein declared.

3. To induce and maintain the united action of all elements of the Construction Industry under adequate governmental or private sanctions and supervision, to eliminate unfair competitive practices and to advance the public interest, to reduce and relieve unemployment, to improve standards of labor and living and otherwise to rehabilitate the Construction Industry, and effectuate the policies set forth in the National Industrial Recovery Act, this Code of Fair Competition governing the Construction Industry is adopted.

4. *Definition*—The term "Construction Industry" as used herein is defined to mean the designing, the constructing, and the assembling, installing and applying of manufactured parts and products and the supplying of materials of (a) building structures, including modifications thereof

and fixed accessories thereto, intended for use as shelter; and (b) fixed structures and other fixed improvements and modifications thereof intended for use in sanitation, transportation, communications, flood control and water power development, reclamation and other similar services required for the public welfare; and the term "Construction Industry" is further defined to include those persons who perform such functions, being commonly known and sometimes defined by law, as architects, engineers, contractors, subcontractors, producers, fabricators and distributors. The term "person" as used herein is taken to mean a natural person, partnership, company, association, corporation or agency.

5. Employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection.

6. No employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing.

7. Employers shall comply with the maximum hours of labor, minimum rates of pay and other conditions of employment, approved or prescribed by the President.

8. *Minimum Wages*—Employers in the Construction Industry shall pay wages not less than the minimum rates which are established regionally or locally by mutual agreements between truly representative groups of employers and employees and approved by the President, as provided by Section 7 (b) of the National Industrial Recovery Act. Where such rates are not so established the minimum rate of wages shall be not less than forty cents (40c.) per hour, unless the hourly rate for the same class of work on July 15, 1929, was less than forty cents (40c.) per hour, in which case the hourly rate shall be not less than that of July 15, 1929, and in no event less than thirty cents (30c.) per hour, except where a lower minimum rate has been otherwise established for specific projects by competent governmental authority acting in accordance with law.

9. *Maximum Hours*—Employers within the construction industry shall not require any individual directly employed on any construction project to work more than an average of 35 hours a week for any six months period but with the right to work a maximum week of 48 hours in such period but not more than 8 hours in any one day, except those in executive, administrative and supervisory position, and except in cases of emergency requiring the protection of life or property.

10. Nothing herein shall be construed as preventing voluntary agreements establishing a lesser maximum number of hours as provided in the National Industrial Recovery Act.

11. Employers in the construction industry shall not employ any minor under the age of 16 years unless otherwise provided in state laws.

12. The President of the United States may cancel or modify any provision in this Code of Fair Competition for the Construction Industry.

13. Amendments or revisions may be proposed by any party of interest and when within the construction industry such proposals shall be made through the national trade association or professional body representative of that function within the construction industry to which the proponent is classified.

14. *Administration committee*—To effectuate the purpose of this code and provide for administration within the industry there is established a "National Industrial Administrative Committee" which shall be the policy committee of the Construction League of the United States and three members to be appointed by the Administrator of the National Recovery Act. This committee shall have authority to establish subcommittees and local, state or regional committees, subcommittees or agencies, with such delegated powers as it may deem necessary. This committee may from time to time present to the Administration recommendations based on conditions in the industry as they may develop, which will tend to effectuate the operation of the provisions of this code and such supplemental codes proposed or made a part of this code and the policy of the National Industrial Recovery Act.

15. *Supplemental codes.*—It is intended that this code for the construction industry be amplified and expanded by supplemental codes prepared and proposed by national trade associations and professional bodies within the construction industry representative of the various functions of the construction industry or sub-divisions thereof. These supplemental codes shall be administered by their own administration committees or agencies which in turn may appeal to the national administrative committee herein established in the event of any controversy arising under the National Industrial Recovery Act.

16. Supplemental codes prepared by national trade association or professional bodies within the construction industry may be proposed to the Administrator of the National Industrial Recovery Act by the national administration committee of the construction industry when consistent with this code and other rules or regulations promulgated by the President and with the spirit and purpose of the National Industrial Recovery Act. Nothing herein contained shall be construed to prevent a trade association from submitting a code to the National Administrator direct.

17. No one in the construction industry shall be a party to the unfair practice known throughout the industry as "bid peddling." All supplemental codes before receiving the approval of the national administrative committee shall contain provisions to enforce this rule.

18. *Administrative expense*—All persons as defined in this code shall bear their proportionate share of the expense incident to securing the approval of and administration of this code of fair competition under such rules and regulations as may be approved by the President under section 10 (A) of Title I of the National Industrial Recovery Act.

19. *Effective date*—This code shall become effective on approval by the President of the United States and shall be applicable to all construction work undertaken pursuant to contracts entered into or otherwise commenced after such approval date.

Engineering Contracts and Capital

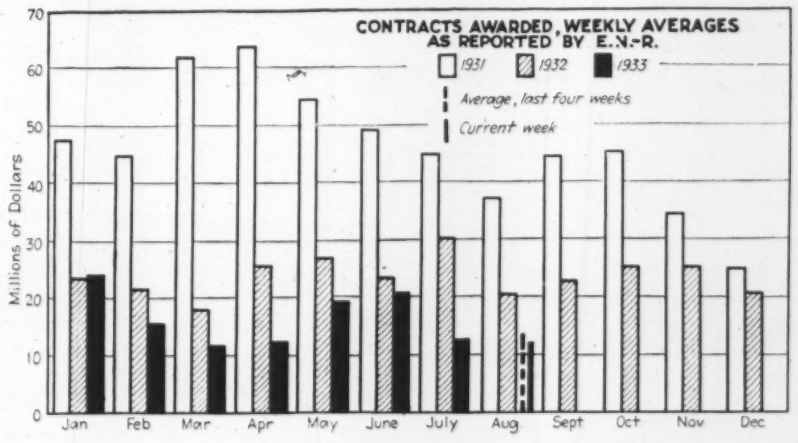
HEAVY engineering construction contracts reported for the past week total $12,189,000, about the average of the past five weeks. Private contracts amounted to $6,076,000, close to the average of the past month, and public works also maintained the low average of the past few weeks with $6,113,000 reported in contracts. Federal awards were the lowest ever recorded since the start of our contract compilations in 1913, amounting to only $52,000 for the week. No increased activity is looked for in public works construction until the federal program gets under way. Private construction will also probably pick up once the various codes of practice and business regulation are fully adopted. Many large private projects are reported as ready to start.

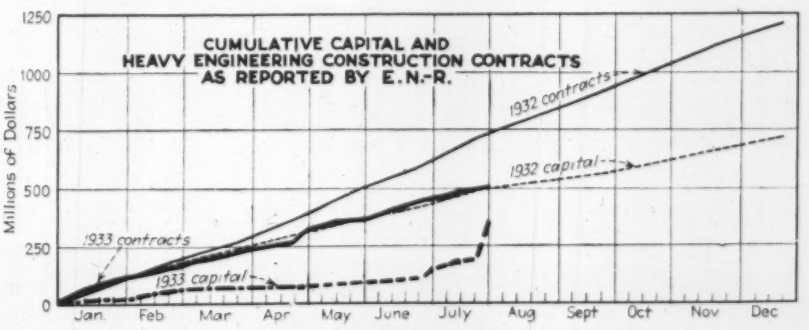
CONSTRUCTION
(Thousands of Dollars)

	Weekly August 1932	Average Four Weeks	Week Aug. 3 1933
Federal Government	$4,177	$661	$52
State and municipal	12,440	6,523	6,061
Total public	$16,617	$7,184	$6,113
Total private	3,792	6,328	6,076
Week's total	$20,409	$13,512	$12,189
Cumulative to date:			
1932		$738,982	
1933		508,187	

NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

	Weekly July 1932	Average Four Weeks	Week July 29, 1933
New capital issues	$19,000	$45,590	$168,765
Cumulative to date:			
1932		$496,000	
1933		352,116	





Business Side of Construction

Construction Marking Time; Materials Prices Continue Rise

CONSTRUCTION ACTIVITY in July, measured by new contract awards, was practically at a standstill. Public works were held up pending organization of the federal program, while private work was apparently sidetracked in the rush of industry to complete the multitude of codes and regulations required by the National Recovery Act. Indications point to a continued low volume of construction during the first half of August, with prospects bright for a rapid increase in activity during the latter half of the month and during September. The several state highway departments report plans for resumption of long-neglected programs within the next few weeks.

During July (four weeks) contracts reported totaled $50,368,000, or an average of $12,594,000 per week, as compared with 20.9 millions in June, and 30.1 millions per week in July, 1932, the heaviest month of last year. Private contracts, which exceeded public works in June with 10.9 millions per week, dropped to an average of 6.1 millions in July. Public works for July averaged 6.5 millions per week, as compared with 10 millions the previous month. Practically every class of construction showed a loss in July as compared with June, except commercial buildings, which increased from 1.2 millions per week to 1.9 millions, and public buildings, which showed a slight gain from 1.5 millions to 1.7 millions per week. Highway contracts let in July were less than half the volume of the June awards, amounting to only 3.1 millions per week.

The upward trend in construction materials prices, which started in May, continued through July. The most important rise reported during the month was an increase of 25c. per bbl. in cement, put into effect in most all eastern and mid-western mills. In some cases the advance were 15c., but only at mills that were already 10c. ahead of others in the surrounding territory. Lumber prices, both retail and wholesale, continued to soar, with one producer terming the situation in lumber prices as "dizzy." Lumber quotations at the moment are extremely erratic, with little connection between prices in centers of adjacent territories. The lumber prices quoted in the following pages indicate the discrepancy between adjacent markets. Many producers hesitated in quoting any price at all for the time being. In almost every case where commodity prices were not reported as actually having increased last month, notation was made to the effect that price rises were both certain and imminent.

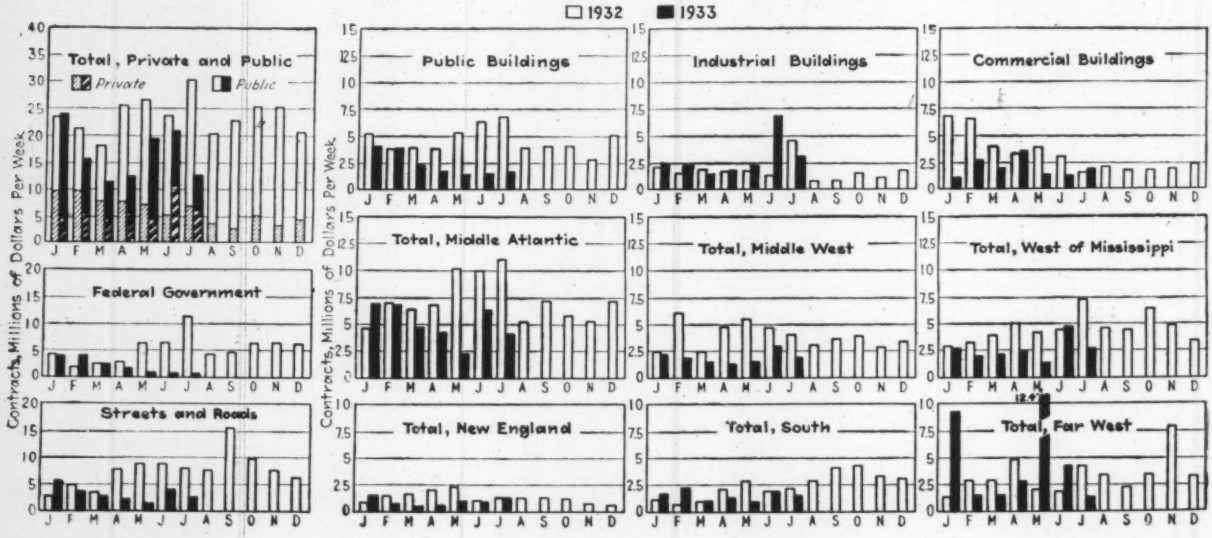
Lime prices, which increased in the past few weeks, are reported headed for another rise. Brick, sand, gravel and stone are also slated for early increases in most communities. Practically all steel products, except structural plates and shapes, have

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN JULY, 1933

Four Weeks—Thousands of Dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States July, 1933	United States Seven Months 1933	United States Seven Months 1932	Canada July, 1933
Public Works										
Waterworks	738	174	.....	346	186	1,109	2,553	54,802	14,304	77
Sewers	510	116	784	62	81	35	1,588	9,923	15,049	421
Bridges, public	452	1,323	126	195	350	78	2,524	53,599	30,987	....
Earthwork and waterways	69	127	148	22	200	409	975	23,931	51,722	76
Streets and roads	1,082	958	719	2,942	2,988	2,237	10,926	94,750	189,399	980
Buildings, public	1,105	3,451	137	698	1,156	203	6,750	69,069	150,723	....
Unclassified, public	80	68	43	18	355	151	715	7,589	31,822	94
Total public	4,036	6,217	1,957	4,283	5,316	4,222	26,031	313,663	484,006	1,648
Federal gov't. (included in above classifications)	237	373	145	543	525	805	2,628	57,569	150,208	....
Private										
Bridges, private	....	61	10	83	91	....	245	3,684	2,624	....
Buildings, industrial	696	3,520	3,651	2,071	1,795	864	12,597	89,969	63,777	356
Buildings, commercial	116	6,226	205	505	205	400	7,657	56,276	123,727	350
Unclassified, private	55	162	29	557	2,910	125	3,838	32,406	43,914	....
Total private	867	9,969	3,895	3,216	5,001	1,389	24,337	182,335	234,567	706
July, 1933 (4 Weeks)	**4,903**	**16,186**	**5,852**	**7,499**	**10,317**	**5,611**	**50,368**	....	....	**2,354**
June, 1933 (5 weeks)	4,496	31,512	7,830	14,894	24,003	21,465	104,200	....	....	1,755
July, 1932 (4 weeks)	5,285	44,229	8,670	16,562	29,063	16,649	120,458	....	....	5,758
Seven months, 1933	26,986	151,171	45,071	58,353	77,685	136,732	....	495,998	....	13,998
Seven months, 1932	48,251	265,722	50,206	130,970	134,398	89,026	....	....	718,573	27,006

CONTRACTS REPORTED - WEEKLY AVERAGES - 1932-1933



increased in price during the past month. Structurals are expected to go up in cost with the slightest increase in volume of sales.

Steel—The rapid rise in output of steel ingots, continuing since last March, was checked in July, after reaching an estimated output of 59 per cent of capacity. The output at the end of the month was rated at 57 per cent, with further recession expected with the usual summer slump. The American Iron & Steel Institute reports that in June the average output was 45.96 per cent of capacity. The Institute reports the June output as 2,597,000 tons, bringing the total output for the first six months to 8,989,192 tons, as compared with 7,697,210 tons for the first half of last year.

Cement—The portland cement industry in June, 1933, produced 7,804,000 bbl., shipped 7,979,000 bbl. and had in stock at the end of the month 19,942,000 bbl., according to the U. S. Bureau of Mines. Production in June showed a decrease of 1.5 per cent and shipments a decrease of 13.9 per cent as compared with June, 1932. The total production of the first half of 1933 amounted to 27,668,000 bbl., as compared with 34,156,000 bbl. for the first half of last year. In June production was rated at 35.2 per cent of capacity, nearly equalling the rate of 35.7 per cent for June, 1932. The May, 1933, production was rated at 27.4 per cent of capacity.

Lumber—A reverse of the trend in lumber production as related to shipments and sales was noted in July, for the first time in months production exceeding shipments. Production during the closing weeks of the month was the heaviest since June, 1931, while orders and shipments fell off from previous weeks, according to reports of the National Lumber Manufacturers Association.

Labor Notes

According to figures compiled by the American Federation of Labor, 1,200,000 workers left the unemployed list from March to May, but 12,500,000 were still unemployed late in June. Union figures show 24.6 per cent unemployed in June, a decline from the March figure of 26.6 per cent.

New Orleans—Workmen of all classes on the New Orleans Public Belt Ry. and highway bridge are demanding increases in wages, striking in the meantime. Steelworkers are asking $1 in place of the 65c. rate now in effect. Common laborers want 60c. instead of 25c.; carpenters are asking an increase of 25c. to 75c.; and hoisting engineers want $1 instead of the current 50c. to 80c.

Chicago—Bricklayers will receive $1.50 an hour after Sept. 1, according to an agreement with the Associated Builders. This is an increase of 12½c. over the current rate which has been in effect since last September.

St. Louis—Electricians have agreed to accept a new scale of $1.50, a decrease from the $1.675 scale that expired July 15.

Washington, D. C.—After three weeks of controversy, the dispute between plasterers and employers has been settled. The $14 daily scale now in effect and which was objected to by employers, will remain in effect until Sept. 8, when a reduction of $2 will be made. About 500 plasterers will be affected.

Common laborers on government projects within the city are asking a minimum of 60c. The common rate is now reported to vary from 25c. to 55c.

Colorado—Plans are being made to raise the minimum rate paid highway workers from 50c. to 60c. and possibly 70c.

New Jersey—The state highway department has set 65c. for skilled labor and 40c. for unskilled on all highway work.

CURRENT BUILDING AND CONSTRUCTION TRADES WAGE RATES PER HOUR

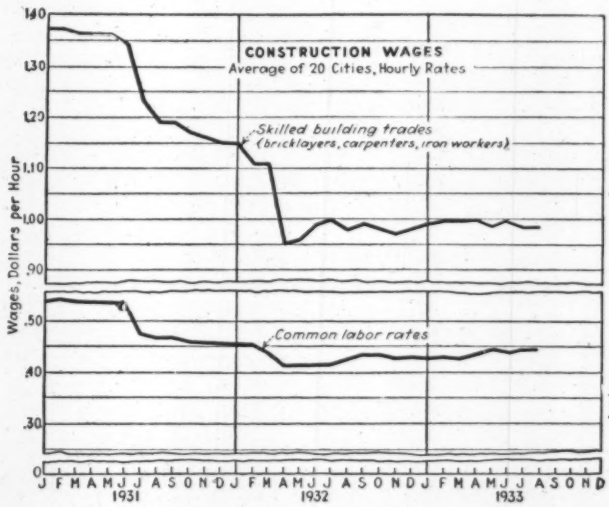
Cities	Bricklayers	Carpenters	Hoisting Engineers	Pile Drivers	Structural Iron Workers	Masons' Laborers	Common Laborers
Atlanta	$0.75@1.12½	$0.40@.90	$0.60@1.25	.....	$0.60@1.25	$0.25	$0.20@.25
Baltimore	1.00	.90	1.00@1.37½	$0.65	1.00@1.25	.40	.30
Birmingham	.75@.87½	.60	.75	.....	.75	.25	.20@.30
Boston	.90@1.30	.60@1.17½	.90@1.17½	.70@1.07½	1.20	.70	.45@.70
Cincinnati	1.27½	1.02½	1.07½	1.07½	1.20	.70	.40@.45
Chicago	1.37½	1.31½	1.31½	1.31½	1.35	.88½	.82½
Cleveland	.90@1.37½	.75@1.12½	.90@1.12½	1.00	.90@1.06½	.56½	.30@.72
Dallas	.62½	.50	.50	.50	.50	.25	.25@.35
Denver	1.00@1.12½	.75@.87½	.75@.87½	.....	.75@.87½	.50	.31¼@.50
Detroit	1.00	.70@.75	.75	.75	.80	.40	.35@.40
Kansas City	1.30	1.00	1.06	1.06	1.00	.70	.35@.60
Los Angeles	.62½	.62½	1.00	1.00	.75	.50	.40@.50
Minneapolis	.90@1.00	.75	.75	.....	.90	.50	.40@.50
New Orleans	1.00	.75	1.00	.70	1.25	.25@.40	.15@.25
New York	1.50@1.65	1.25@1.40	1.50@1.65	1.50	1.65	.81¼@1.00	.50@.75
Philadelphia	.75@1.00	.50@.75	.75@1.00	.60@.75	.75@1.00	.20@.35	.20@.30
Pittsburgh	.60@1.50	.60@1.25	.60@1.37½	1.00@1.18¾	.60@1.37½	.50	.40@.70
St. Louis	1.50	1.25	1.35@1.47	1.25	1.47	1.00	.35@.78¼
San Francisco	1.12½	.90	1.00	1.00	1.20	.75	.65
Seattle	.75@1.20	.50@.90	1.00	.90	1.10	.66	.40@.50
Montreal	.75	.60	.55	.....	.70	.40	.20@.30

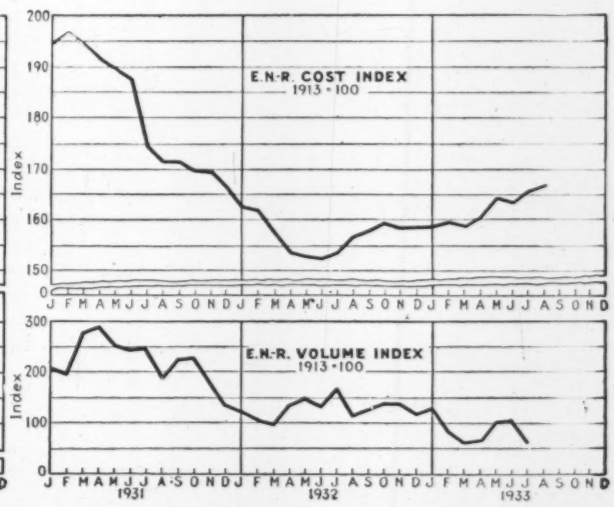
Skilled Average (3 trades) $0.986 Common Average, $0.443

ENR Cost and Volume Index

The Engineering News-Record Construction Cost Index rose again this month to 167.00, the highest since November, 1931, a rise of 1.5 points over the July Index. The current rise is due to increase in the cost of cement. The steel, labor and lumber components remained the same as for the previous month. The low volume of contracts awarded in July lowered the Volume Index to 65, back to the April level. The June Volume Index stood at 109, the highest of the year.

E.N.-R. Cost		E.N.-R. Volume	
August, 1933	**167.00**	**July, 1933**	**65**
July, 1933	165.50	June, 1933	109
August, 1932	156.80	July, 1932	166
1932(Average)	156.97	1932(Average)	127
1931(Average)	181.35	1931 (Average)	220
1930(Average)	202.35	1930 (Average)	260
1913 Average	100		




E.N.-R. COST INDEX
1913 = 100
Index
200
190
180
170
160
150
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
E.N.-R. VOLUME INDEX
1913 = 100
Index
300
200
100
0
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1931
1932
1933

Current Prices of Construction Materials

Building Materials

PORTLAND CEMENT — Prices are for carload lots. For cement in returnable cloth bags add 40c. per bbl.; in non-returnable paper bags add 15c. per bbl., to following net prices:

	F.o.b.	Delivered		F.o.b.	Delivered
Atlanta	$2.53	$3.10	Kansas City	$1.75	$1.85
Baltimore	....	2.03	Los Angeles	2.10	....
Birmingham	2.27	2.37	Minneapolis	2.45	2.60
Boston	2.12	2.32	Montreal	1.70	....
Chicago	1.60	1.95	New Orleans	1.90	2.20
Cincinnati	2.56	2.71	New York	1.88	2.20
Cleveland	2.02	2.07	Philadelphia	1.94	2.04
Dallas	2.30	2.45	Pittsburgh	2.12	2.57
Denver	2.65	2.81	St. Louis	1.74	2.15
Detroit	1.97	2.25	San Francisco	2.05	....
			Seattle	2.55	2.70

Current mill-prices per barrel to dealers, for carloads of 132 barrels or over, without including charge for four bags, f.o.b. Bag charges same as in preceding table:

Alpena, Mich	$1.65	Mason City, Ia	$1.70
Buffington, Ind	1.60	Norfolk, Va	1.76
Dallas, Tex. (Inc. 5c. tax)	1.80	Northampton, Pa	1.65
Hannibal, Mo	1.60	North Birmingham, Ala	1.75
Hudson, N. Y	1.75	Richard City, Tenn	1.70
Independence, Kan	1.70	Saginaw, Mich	1.65
Ironton, Ohio	1.60	Steelton, Minn	1.70
Iola, Kan	1.70	Universal, Pa	1.65
La Salle, Ill	1.60	Waco, Tex	1.75
Limedale, Ind	1.60	Wyandotte, Mich	1.60

SAND AND GRAVEL — Per ton, carload lots, gravel, size ¼-in.:

	Gravel		Sand	
	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$2.11	$2.61	$1.65	$2.50
Baltimore	....	2.35	....	2.08
Birmingham, per cu.yd	....	3.00	....	2.40
Boston	1.40	1.65	.90	1.15
Chicago, per cu.yd	....	2.25	....	2.25
Cincinnati	1.20	1.65	.95	1.40
Cleveland	....	2.00	1.40	2.00
Dallas, per cu.yd	1.40	2.40	1.65	2.40
Denver, per cu.yd	1.75	....	1.15	....
Detroit	.75	1.75	.75	1.45
Kansas City (at plant)	.65	....	.60	....
Los Angeles	1.45	1.60	1.00	1.10
Minneapolis	....	1.60	....	.75
New Orleans	1.40	2.40*	1.20	2.00*
New York, per cu.yd	1.50	3.50	1.00	2.25
Philadelphia	....	1.85	....	1.52
Pittsburgh	....	1.20	....	1.40
St. Louis	.80	1.40	.80	1.25
San Francisco	1.65	....	1.65	....
Seattle, per cu.yd	1.75	....	1.75	....

*Cu.yd.

CRUSHED STONE — Per ton, size 1½-in., carload lots, limestone:

	F.o.b.	Delivered
Atlanta	$1.50	$2.00
Baltimore	....	2.60
Birmingham	.80	1.05
Boston	1.40	1.65
Chicago, per cu.yd, 2,500 lb	....	2.25
Cincinnati	1.65	1.85
Cleveland	....	2.00
Dallas, per cu.yd., 2,500 lb	1.65	3.00
Denver, granite, per cu.yd., 2,700 lb	....	2.50
Detroit	....	2.00
Kansas City (at plant)	1.00	....
Los Angeles	1.45	1.60
Minneapolis	....	1.60
New York, per cu.yd., 2,800@3,000 lb	1.75	3.25
Philadelphia	....	2.20
Pittsburgh	....	2.25
St. Louis	1.05	1.65
San Francisco, trap rock	....	1.65
Seattle, per cu.yd., 3,000 lb	1.10	....

CRUSHED SLAG—Prices for carloads, per net ton, at plant:

	1½-In.	¾-In.	Roofing	Slag Sand
Birmingham	$0.90	$1.15	$2.05	$0.55
Buffalo	1.35	1.35	1.85	1.25
Cleveland	1.70	1.70	....	1.35
Toledo	1.20	1.20	1.20	1.10
Western Pennsylvania	1.25	1.25	2.00	1.25
Youngstown	1.10	1.20	2.00	.75

CONCRETE BLOCKS—Standard, 8x8x16-in., hollow, delivered to job, each:

Baltimore (8x12x12)	$0.20	Kansas City	$0.18
Birmingham (5x8x12)	.084	Los Angeles	.125
Boston	.14	Minneapolis	.10
Brooklyn and Queens	.09	Montreal	.12
Chicago	.175	New Orleans	.16
Cleveland	.165	Philadelphia	.15
Denver	.15	Pittsburgh	.18
Detroit	.08	St. Louis	.14

READY MIXED CONCRETE—Per cu.yd., 1:2:4, delivered 50 cu.yd. or more:

Atlanta	$8.00	Los Angeles	$6.10
Birmingham	5.75	Minneapolis	6.00
Boston	6.00	New Orleans	6.05
Cleveland	7.50	New York (Manhattan)	8.50
Cincinnati	6.50	Philadelphia	6.84
Dallas	7.00	Pittsburgh	6.05
Detroit 1:2½:5	4.75	St. Louis	6.80
Kansas City	7.50	Seattle	5.35

HOLLOW TILE—Building tile per block, delivered to contractors in lots of 2,000 pieces or over:

	4x12x12	6x12x12	8x12x12	10x12x12	12x12x1
Atlanta	$0.09	$0.11	$0.13	$0.20	$0.25
Baltimore	.10	.14	.20	.22	.30
Birmingham	.089	.122	.167	.219	.25
Boston	.0775	.1065	.1453	.1799	.208
Chicago	.0484	.063	.09	.1179	.13
Cincinnati	.06815	....	....	.165	....
Cleveland	.048	.066	.09	.117	.13
Dallas	.0455	....	....	.117	....
Denver	.085	.135	.175	.19	.25
Detroit	.0505	.065	.0947	.1175	.1305
Kansas City	.0735	.092	.15	.1777	.20725
Los Angeles	.085	....	....	.22	....
Minneapolis	.0692	.0988	.1372	.1447	.2029
New Orleans	.08	....	....	.22	....
New York	.076	.118	.147	....	....
Perth Amboy	....	....	....	.2388*	.2956*
Philadelphia	.065	.093	.14	.175	.195
Pittsburgh	.0435	.065	.088	.1165	.126
St. Louis	.06	.082	.112	.155	.19
San Francisco	.0765	.105	.1765	....	....
Seattle	.085	.115	.18	....	....

*At plant. (Load-bearing tile).

BRICK — Prices per thousand in carload lots, as follows:

	Common Backing		Paving
	F.o.b.	Delivered	F.o.b. 3x8½x4-in.
Atlanta	$9.00	$12.50	$32.00
Baltimore	....	12.00	43.00†
Birmingham	10.00	12.50	25.00
Boston	11.50	13.00	30.00
Chicago	....	9.00	32.00
Cincinnati	13.50	16.00	36.50
Cleveland	14.00	16.00	33.00
Dallas	8.50	10.00	25.00†
Denver	13.00	....	40.00
Detroit	....	11.50	35.25
Kansas City	12.00	14.00	35.00
Los Angeles	....	11.00	....
Minneapolis	....	6.00	....
Montreal	18.75	....	....
New Orleans	11.00	14.00	40.00
New York	9.50	12.50	45.00
Philadelphia	....	13.00	40.00
Pittsburgh	11.00	13.00	35.00
St. Louis	....	11.00	36.00†
San Francisco	....	14.00	45.00*
Seattle	12.00	14.00	....

*2½x8½x4 in. †3½x8½x4 in.

LIME — Prices of hydrated, per ton, in paper; lump, per 180-lb. bbl., net:

	Hydrated				Common Lump,	
	Finishing		Common			
	F.o.b.	Delivered	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$17.50	$20.00	$11.50	$14.00	....	$2.50
Baltimore	....	21.00	....	14.00	....	....
Birmingham	21.00	....	12.00	....	$1.65	....
Boston	16.00	18.50	11.50	15.00	2.65*	3.50*
Chicago	....	20.00	....	14.00	....	2.75
Cincinnati	13.50	14.50	8.65	9.65	....	....
Cleveland	13.00	18.00	11.50	16.00	....	2.60
Dallas	....	20.00	....	....	....	2.75
Denver	....	30.00	....	22.00	....	2.85*
Detroit	....	20.00	....	16.00	....	....
Kansas City	19.00	20.00	....	20.00	....	2.75
Los Angeles	....	22.00	....	19.00	....	2.00
Minneapolis	....	25.50	....	21.00	....	1.70
Montreal	....	....	12.00	13.00	....	....
New Orleans	17.00	24.50	10.00	13.00	1.66	1.95
New York	14.20	18.00	11.10	15.00	2.65*	3.55*
Philadelphia	14.55	19.00	10.90	14.45	....	1.28
Pittsburgh	14.50	16.00	9.95	11.45	1.85	2.35
St. Louis	....	22.00	....	20.00	....	2.75
San Francisco	22.50	....	19.00	....	1.59	....
Seattle	....	32.00	....	24.00	....	2.80

*Per 280-lb. bbl. (net.)

LIMESTONE—Mill blocks, f.o.b. siding, per cu.ft.:

New York:* Rustic buff, $1.38; Standard gray, $1.48; Standard buff, $1.58; Selected gray, $1.58; Selected buff, $1.68; Variegated, $1.38.
Boston: Rustic buff, $1.47; Standard, $1.57; Selected buff, $1.67.
Pittsburgh: Rustic buff, $1.14; Standard, $1.24 at quarry; Selected buff, $1.34.
Philadelphia: Sel. buff, $1.59; Sel. gray, $1.49; Standard, $1.49; Standard gray, $1.39; Rustic buff, $1.39.
Atlanta: Standard $1.26.
*F.o.b. Bedford, freight allowed to N. Y.

Road and Paving Materials

PAVING STONE — Granite, lots of 50,000 blocks, 4x8x4-in., dressed, f.o.b. city:

Atlanta	$3.50 per sq.yd.
Baltimore	4.00 per M.
Birmingham (3½x8½x4-in.)	76.25 per M.
Boston	75.00 per M.
Chicago, 5 in	3.80 per sq.yd.
Cincinnati	110.00 per M.
Cleveland	96.00 per M.
Dallas	25.00 per M.
Detroit, 5 in	2.80 per sq.yd.
Kansas City	2.75 per sq.yd.
Minneapolis, 4½ in	2.80 per sq.yd.
Montreal	104.75 per M.
New Orleans	2.80 per sq.yd.
New York, 5 in	135.00 per M.
Philadelphia, 4x10x5	115.00 per M.
Pittsburgh	115.00 per M.
St. Louis, 5 in	2.80 per sq.yd.

Current Prices of Construction Materials

Road and Paving Materials—Continued

WOOD-BLOCK PAVING — Prices f.o.b., in carload lots:

	Size of Block	Treatment	Per Sq.Yd.
Atlanta	3½	16	$2.25
Boston	3½	16	2.00
Chicago	3½	12	1.90
Kansas City	3½	16	2.75
Minneapolis	2½	8	1.65
Montreal	3½	16	2.63
Philadelphia	3½	16	2.02
St. Louis	3½	16	2.00

CURBING—Per lin.ft., 5x16 in., straight, rough, f.o.b., in carload lots:

Atlanta	$0.41	Kansas City	$0.60
Birmingham	.50	New York	.58
Boston	.60	Philadelphia (6x20 dressed)	1.40
Dallas	.60	Pittsburgh	.80
Detroit	.45	St. Louis	.70

ASPHALT—Paving asphalt, f.o.b., per ton. Packages are 350-lb. bbl. or 425-lb. drums, in carload lots:

	Packages	Tank-car or -boat
Atlanta	$21.60	$17.40
Baltimore	19.00	15.00
Birmingham	.....	11.00
Boston	20.00	16.00
Chicago	22.50	15.50
Cincinnati (f.o.b. refinery)	18.00	14.00
Cleveland	18.00	14.00
Dallas	.....	27.00
Denver	27.50	.....
Detroit	18.29	14.29
Kansas City (f.o.b. refinery)	18.00	12.00
Los Angeles	16.50	10.50
Maurer, N. J. (Bermudez)	.....	26.00
Maurer, N. J. (Trinidad)	.....	22.00
Minneapolis (f.o.b. Twin Cities)	23.30	18.30
Montreal (f.o.b. factory)	18.66	13.00
New Orleans	17.00	13.00
New York	19.00	15.00
Philadelphia	17.00	11.00
Pittsburgh	25.00	16.00
St. Louis	21.70	17.70
San Francisco (f.o.b. refinery)	16.00	10.00
Seattle	21.10	16.00

LIQUID ASPHALT — Residual, hot application, f.o.b., in tank cars, 8,000 gal. minimum, per gal.:

Atlanta	$0.0689
Baltimore	.06
Birmingham	.06
Boston	.06
Cincinnati	.075
Dallas	.05
Kansas City	.05
Los Angeles	.05
Montreal at (refinery)	.09
New York	.06
Philadelphia	.08
Pittsburgh	.05
St. Louis	.07

EMULSIFIED ASPHALT — For penetration and surface treatment, per gal.:

Boston, applied	$0.13
Cincinnati, f.o.b. refinery	.06
Los Angeles, applied	.13
Des Moines, applied	.14
New York, applied	.15
Philadelphia, applied	.15
St. Louis, applied	.13½
Seattle, f.o.b. refinery	.08

Iron and Steel

	Pittsburgh	Chicago	Birmingham
STRUCTURAL SHAPES AND PLATES, per 100 lb., base, carload lots	$1.60	$1.70	$1.75
CONCRETE REINFORCING BARS, ½ in., billet, per 100 lb., carload lots	1.75	1.75	1.75
SHEETS, per 100 lb., carload lots:			
Hot-rolled No. 10	1.65	1.90	1.80
Hot-rolled annealed No. 24	2.25	2.35	2.40
Galvanized No. 24	2.85	2.95	3.00
RIVETS per 100 lb., ½ in., structural, carload lots	2.50	2.60	2.40
SHEETPILING, per 100 lb., base, carload lots	1.90	2.05	.....
WIRE NAILS, per 100 lb., base, carload lots	2.10	2.10	2.30
HEAVY MELTING STEEL SCRAP, No. 1, per gross ton, at consuming point	13.75	10.50@10.75	8.25@8.75

TRIANGLE MESH—Plain, per 100 sq.ft., in carload lots:

Style Number	Size, In.	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
032	4x4	22	$0.94	$0.96
049	4x4	28	1.19	1.22
068	4x4	35	1.45	1.49
093	4x4	45	1.87	1.91
126	4x4	57	2.31	2.37
153	4x4	68	2.75	2.82
180	4x4	78	3.16	3.24
245	4x4	103	4.17	4.27
287	4x4	119	4.82	4.94
336	4x4	138	5.59	5.73
395	4x4	160	6.48	6.64
036P	4x8	17	.71	.73
053P	4x8	24	1.01	1.03

TRIANGLE MESH—*Continued*

Style Number	Size, In.	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
072P	4x8	31	1.27	1.30
097P	4x8	40	1.64	1.68
049R	4x8	24	1.01	1.03
067R	4x8	31	1.27	1.30
089R	4x8	40	1.64	1.68

WIRE ROPE—Discounts from manufacturers' list prices on regular grades of bright and galvanized, Eastern Territory, New York, and East of Missouri River:

	Base
Cast steel round strand rope	20 %
Galvanized iron rigging and guy rope (add to list)	12½%
Galvanized steel rigging and guy rope	7½%
Plow steel round strand rope	35 %
"Special Steel" and extra strong cast steel, round strand rope	27½%

Discount 5 points less than discount for Eastern territory: California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Washington and Wyoming. Discount 10 points less than discount for Eastern territory: Arizona, Idaho, Montana and Utah.

EXPANDED METAL LATH—Per 100 sq.yd., painted, f.o.b., in carload lots 2.2 lb. per sq.yd., standard-mesh diamond lath:

Atlanta	$15.00	Los Angeles	$17.00
Birmingham	17.00	Montreal (2.5 lb.)	24.00
Boston	15.00	New Orleans	20.00
Chicago	10.60	New York	13.50
Cincinnati	11.00	Philadelphia	13.50
Dallas	16.00	Pittsburgh	13.50
Detroit	18.00*	St. Louis	19.00*
Kansas City	17.00*	San Francisco	17.00*
*Delivered.		Seattle	17.00

STEEL FREIGHT RATES — Per 100 lb., effective Dec. 3, 1931, on finished steel products in the Pittsburgh District, including plates, structural shapes, merchant-steel bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc.; 40,000 lb. per car:

Atlanta, 36,000 lb.	$0.60	Detroit	$0.285
Baltimore	.29	Kansas City	.59
Birmingham	.60	New Orleans, 36,000 lb.	.69
Boston	.42	New York, 40,000 lb.	.35
Buffalo	.255	Pacific Coast, 60,000 lb.	1.17*
Chicago	.36	Philadelphia	.31
Cincinnati	.285	St. Louis	.41
Cleveland	.205	St. Paul	.60
Denver	.92	* All rail.	

Railway Materials and Supplies

STEEL RAILS — Per gross ton, f.o.b.

	Pittsburgh	Birmingham	Chicago
Standard rails	$40.00	$40.00	$40.00
Light rails	30.00	30.00	30.00
Re-rolled rails	26.00	.....	27.00

RAILWAY TIES — Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In by 8½ Ft.
Boston	Oak, untreated	$0.90	.....
	Pine, untreated	.85	.....
	Pine, creosoted	1.40	.....
New York	Long-leaf sap pine, untreated	.80	$1.00
	Mixed oak, untreated	....	1.00
Birmingham	White oak, untreated	.75	1.50
	White oak, creosoted	1.40	1.45
	Southern pine, untreated	.35	.60
	Southern pine, creosoted	.95	1.35
Chicago	White oak, untreated	1.05	1.35
	Oak, empty cell, creosoted	1.40	1.80
	Oak, zinc treated	1.25	1.65
	Southern pine, creosoted	1.15	1.50
Los Angeles	Fir, untreated	.45	.....
	Fir, creosoted	1.15	.....
Philadelphia	Red oak, untreated	.95	1.15
	Red oak, creosoted	1.47	1.90
St. Louis	White oak, untreated	.95	1.40
	Red oak, untreated	.85	1.30
	Red oak, creosoted	1.22	1.80
	Sap pine or cypress, untreated	.75	1.10
San Francisco	Douglas fir, green, untreated	.45	.63
	Douglas fir, empty cell, creosoted	1.14	1.56
Montreal	Birch or maple, untreated	1.00	1.00
	Birch or maple, creosoted	1.25	1.55

TRACK SUPPLIES — Prices per 100 lb., f.o.b., for carload lots:

	Pittsburgh	Birmingham	Chicago
Angle bars	$2.55	$2.55	$2.75
Standard spikes	2.40	2.40	2.60
Tie plates	1.75	1.85	1.85
Track bolts	3.50	3.50	3.50

Pipe

WROUGHT STEEL PIPE — Discounts from standard list for delivery from warehouse, except at Pittsburgh, where prices are f.o.b. mill. List prices per ft. as follows: 1-in., 17c.; 3-in., 76½c.; 3½-in., 92c.; 6-in., $1.92.

	1 to 3-In. Butt Weld		2½ to 6-In. Lap Weld	
	Black	Galvanized	Black	Galvanized
Atlanta	52%	44.5%	50%	42%
Chicago	57.25%	44.71%	53.83%	41.29%
Cleveland	53.3%	42.3%	50.8%	37.8%
New York	56.14%	43.6%	52.72%	40.18%
Philadelphia	57.28%	44.68%	53.68%	41.80%
Pittsburgh	67½%	58½%	68½%	59½%
St. Louis	60%	50%	58%	48%

Current Prices of Construction Materials

Pipe—Continued

CAST-IRON PIPE — Prices per net ton, for bell and spigot pipe, Class B and heavier, f.o.b. in carload lots; gas pipe and Class A, $3.00 per ton extra:

	4-In.	6-In. and Over
Atlanta	$39.50	$36.50
Boston	44.00	41.00
Birmingham (Base)	35.00	32.00
Burlington (Base)	38.00	35.00
Chicago	43.50	40.50
Dallas	47.50	44.50
Los Angeles	43.50	40.50
New York	41.50	38.50
Philadelphia (rail delivery)	39.50	36.50
Pittsburgh	44.50	41.50
St. Louis	42.50	39.50
San Francisco	43.50	40.50

SEWER PIPE—Prices delivered, per foot, for standard pipe; 6, 8 and 12-in. are single strength and 18, 24, 30 and 36-in. are double strength:

	6-In.	8-In.	12-In.	18-In.	24-In.	30-In.	36-In.
Atlanta	$0.135	$0.21	$0.385	.....	$1.40.	.....	.....
Baltimore	.10	.30	.58	.....	1.93	.....	$6.50
Birmingham	.18	.30	.54	$1.02	1.95	$3.50	5.00
Boston	.135	.21	.405	1.325	2.385	4.68	7.175
Chicago	.18	.28	.54	1.25	2.25	4.75	6.00
Cincinnati	.0945	.....	.2835	.....	1.125	2.448	.....
Cleveland	.1575	.245	.4725	1.25	2.25	3.96	6.15
Dallas	.236	.....	.7165	.....	2.70	.....	.....
Denver	.16	.23	.414	.816	1.44	.....	.....
Detroit	.16	.25	.45	1.125	2.025	3.80	.....
Kansas City	.21	.335	.52	1.00	1.90	3.80	.....
Los Angeles(f.o.b.)	.2175	.2825	.5085	1.1865	2.034	3.69	.....
Minneapolis	.15	.21	.415	.95	1.72	2.85	3.75
Montreal	.30	.45	.75	1.95	2.60	.....	7.20
New Orleans	.16	.....	.51	.....	1.90	.....	.....
New York	.1665	.259	.4995	1.325	2.385	.....	.....
Philadelphia	.081	.126	.243	.65	1.17	2.376	4.615
Pittsburgh	.09	.18	.27	.62	1.22	2.45	3.68
St. Louis	.09	.205	.369	.945	1.62	3.20	4.40
San Francisco	.175	.25	.45	1.05	1.80	3.00	4.50
Seattle	.175	.275	.54	1.20	2.00	3.00	5.50

CLAY DRAIN TILE—Per 1,000 lin.ft., f.o.b., in carload lots, 4 in.:

Atlanta	$50.00	Los Angeles	$60.00
Birmingham	50.00	New Orleans	40.00
Boston	50.00	New York	35.00
Chicago	40.00	Philadelphia	36.00
Dallas	65.00	Pittsburgh	80.00
Denver	75.00	St. Louis	40.00
Detroit	60.00	San Francisco	67.50
Kansas City	60.00	Seattle	45.00

Miscellaneous

LINSEED OIL—Raw, in 5-bbl. lots, per lb., f.o.b.:

Atlanta (per gal.)	$0.80	Minneapolis	$0.122
Birmingham	.066	Montreal (per gal.)	.49
Boston (per gal. delivered)	.94	New York	.111
Dallas (per gal.)	.6375	Philadelphia	.075
Denver	.11	Seattle (per gal.)	.69
Kansas City (per gal.)	.80	St. Louis	11.5
Los Angeles	.0775	San Francisco (del)	.112

WHITE LEAD—In oil, per 100 lb. keg., f.o.b.:

Atlanta	$12.50	Montreal	$ 9.54
Birmingham	12.50	New Orleans	11.00
Boston	11.00	New York	11.00
Dallas	12.00	Philadelphia	9.90
Kansas City	11.25	Seattle	11.50
Los Angeles	10.25	St. Louis	11.00

CHEMICALS—Water, sewage treatment, road work, f.o.b., carlots, New York:

Bleaching powder, in drums, f.o.b. works, per 100 lb.	$1.75@2.00
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, f.o.b. works, freight equalized with points of competion, per ton	19.50
Chlorine, cylinders, per lb. delivered	.05½
Silicate of soda, in drums, f.o.b. works, per 100 lb.	1.65
Soda ash, 58%, in bags, per 100 lb.	1.22½
Sulphate of aluminum, in 100 lb. bags	1.25@1.40
Sulphate of copper, in bbl., per 100 lb.	3.75

MANILA ROPE—The number of feet per pound for the various sizes is as follows: ¼-in., 6-ft., ½-in.; ⅝-in., 4-ft., 5-in.; ¾-in., 3-ft., 8-in.; 1-in., 2-ft., 5-in.; 1¼-in., 1-ft., 8-in. Following prices are per lb. for ½-in. and larger, delivered in 1,200 ft. coils:

Atlanta	$0.17	Kansas City	$0.22
Baltimore	.225	Los Angeles	.155
Birmingham	.20	Minneapolis (f.o.b.)	.155
Boston	.13	Montreal	.14
Chicago	.175	New Orleans	.165
Cincinnati (f.o.b.)	.21	New York	.155
Cleveland	.20	Philadelphia	.15
Dallas	.28	St. Louis	.145
Denver	.165	San Francisco	.145
Detroit	.195	Seattle	.155

BUILDING PAPER—Black, 50-lb. per roll of 500 sq.ft., in carloads, f.o.b., producing point $2.30

SLATERS FELT—In carloads, per roll, f.o.b., producing point $0.65

PREPARED ROOFING—Per square, f.o.b., in carload lots:

	Single Shingles*	Strip Shingles†	Rolls‡
Atlanta	$5.35	$3.00	$1.75
Boston	5.76	3.18	1.41
Dallas	4.50	3.75	1.75
Detroit	6.50	6.50	1.85
Montreal	6.40	6.20	2.68
New Orleans	5.50	5.40	1.95
New York	6.50	6.25	2.50
Philadelphia	4.40	4.20	1.65
Seattle	8.75	5.50	2.25
St. Louis	6.40	5.22	1.49

*Slate finish, sufficient to cover 100 sq.ft. ‡Slate surfaced, in rolls weighing 85 to 90 lb. †4 in 1, hexagonal shape, with Underwriters' label

ROOFING MATERIALS—In carload lots, f.o.b.:

	Asphalt Felt, per 100 Lb.	Tar Felt, per 100 Lb.	Asphalt Coating, per Gal.	Tar Pitch, per Ton
Atlanta	$44.50†	$44.50†	$0.47	$24.50
Boston	2.40	2.40	.50	23.00
Dallas	2.75	2.75	.65	34.00
Montreal	2.62‡	2.62‡	1.40	1.63**
New Orleans	.....	2.50	.....	22.50
New York	2.40	2.40	.34‡	28.00
Philadelphia	2.25	2.25	.33	20.00
Seattle	2.40	2.40	.55	27.90
St. Louis	2.52	....	.28	26.00

*In 350 lb. barrels. †Per ton. ‡Per roll. **Per English cwt.

WINDOW GLASS—Discounts from latest jobbers list, dated Sept. 15, 1928 for sizes above first three brackets:

	Single Thickness		Double Thickness	
	A Quality	B Quality	A Quality	B Quality
Atlanta	85%	85%	85%	85%
Birmingham	89%	91%	89%	91%
Boston	88%	90%	87%	89%
Dallas	85%	85%	85%	85%
Denver	84@5%	86@5%	84@5%	86@5%
Kansas City	89@10%	89@10%	89@10%	89@10%
New York	87%	89%	87%	89%
Philadelphia	88%	90%	88%	90%
Pittsburgh	87%	89%	87%	89%
Seattle	90@10%	90@20%	90@10%	90@20%

EXPLOSIVES—Price per pound for dynamite delivered:

	Gelatin 40%	Gelatin 60%		Gelatin 40%	Gelatin 60%
Atlanta	$0.215	$0.2375	Los Angeles†	$0.1725	$0.1925
Baltimore	.21	.225	Minneapolis	.1725	.1875
Birmingham	.15	.1725	Montreal	.1675	.1925
Boston	.27	.30	New Orleans	.19	.22
Chicago	.17	.195	New York	.245	.2675
Cincinnati (f.o.b.)	.22	.245	Philadelphia	.215	.24
Dallas	.2125	.2475	St. Louis	.1375	.1525
Denver	.19*	.205*	San Francisco	.1575	.1725
Kansas City, Mo.	.2025	.2225	Seattle	.1525	.175

*F.o.b Louviers. †F.o.b. arsenal.

Lumber

LUMBER—Per M. ft., b.m., No. 1, Common, rough, in carload lots:

SOUTHERN YELLOW PINE

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.	12 x 12 In.† F.o.b
Atlanta	$20.00	$22.50	$20.00	$22.50	$50.00	$57.00	$50.00
Baltimore	.....	46.00	.....	43.00	.....	.....	.....
Birmingham	40.00	50.00	40.00	50.00	50.00	60.00	55.00
Boston	30.00	35.00	31.00	36.00	65.00	70.00	65.00
Chicago	.....	.....	.....	.....	.....	62.50	.....
Cincinnati	.....	28.00	.....	28.00	.....	35.00	35.00
Cleveland	.....	22.00	.....	23.00	.....	30.00	32.00
Dallas	.....	35.00	.....	35.00	.....	50.00	52.50
Denver	.....	33.00	.....	33.00	.....	52.00	58.00
Detroit	30.00	32.00	30.00	32.00	32.00	32.00	45.00
Kansas City	.....	32.00	.....	35.00	.....	47.50	47.50
Minneapolis	.....	38.00	.....	38.00	.....	43.00	.....
Montreal	44.00	.....	45.00	.....	51.00	.....	.....
New Orleans	.....	18.00	.....	19.00	.....	30.00	.....
New York	33.00	35.00	33.50	35.50	66.00	68.00	66.00
Phil. No. 2(com.)	26.00	32.00	27.00	33.00	34.00	38.00	54.00
Pittsburgh	30.00	38.00	30.00	38.00	34.00	44.00	54.00
St. Louis	29.00	34.00	30.00	35.00	48.50	53.50	47.00

DOUGLAS FIR

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.	12 x 12 In.† F.o.b
Baltimore	.....	$43.00	.....	$46.00	.....	$46.00	.....
Boston	$25.00	30.00	$28.00	33.00	$35.00	40.00	$38.00
Chicago	.....	.....	.....	.....	.....	44.52	.....
Cincinnati	.....	.....	.....	.....	.....	42.50	42.50
Cleveland	.....	24.50	.....	26.00	.....	32.50	34.00
Denver	.....	33.00	.....	33.00	.....	52.00	58.00
Detroit	.....	.....	.....	.....	30.00	30.00	45.00
Kansas City	.....	29.00	.....	32.00	.....	36.00	46.00
Los Angeles	24.00	25.50	24.00	25.50	30.00	31.50	31.00
Minneapolis	.....	38.00	.....	38.50	.....	45.00	.....
New Orleans	.....	21.00	.....	21.00	.....	42.50	.....
New York	31.50	32.50	31.00	33.00	37.00	39.00	40.00
Philadelphia	.....	.....	.....	.....	.....	34.00	38.00
Pittsburgh	.....	.....	.....	.....	46.00	58.00	47.00
St. Louis	34.00	39.00	34.00	39.00	35.00	40.00	35.00
San Francisco	.....	17.00	.....	18.00	.....	19.00	19.00
Seattle	19.50	20.50	19.50	20.50	21.50	22.50	22.50

*Form lumber, 16 ft. lengths. †Planks and timbers, 20 ft. lengths.

PILES—Prices of Nichols Bros., 90 West St., N.Y.C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.09	$0.145
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.13	.195
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.15	.215
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.185	.225
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2025	.225
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.265	.375
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.305	.442